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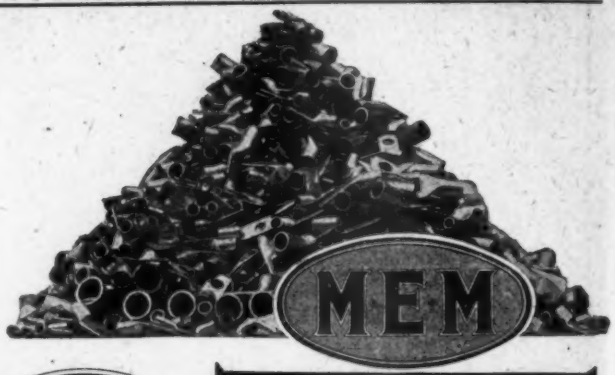

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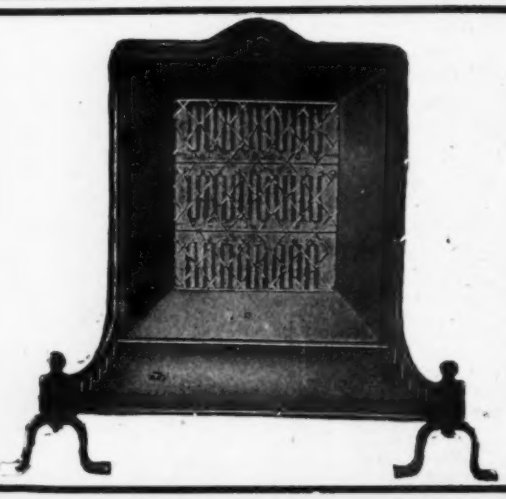

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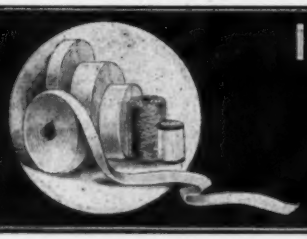

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VOL. LXXXIX. JULY 15, 1921. No. 2,277

ELECTRICAL REVIEW.

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THE CURSE OF PERCENTAGE.

A STUPENDOUS gain that has been achieved by electrical engineers is the ability to work out efficiencies with accuracy. Compared with marine engineers, electrical men seem faddy to a ridiculous extent, but they have proved their case. The older marine men could tell when they made a really big advance, as when they went from compound to triple-expansion engines, but they were in a somewhat confused state when it came to finding out what arose from changes in detail, and indeed sometimes altered their engines in a way which reduced their efficiency, without knowing what had happened.

Nevertheless, the time has come when electrical men must make a new step forward. They have got into too rooted a habit of working on the percentage and similar bases, and good as this may be in a general way, it is possible for a good custom to hamper progress. Years ago, designers tried to work out steam engine consumptions on the b.h.p.-hour basis, but they stuck over it. At no load the engine was using steam, without output, so that the consumption per b.h.p.-hour was infinite. It came down as the load came on, and reached its minimum somewhere about full load. Designers drew out curves, but they did not seem to lead to anything. Then Willans threw over the "per" basis, plotted the total steam consumption against output, and got his straight-line law, which threw a flood of light on the whole matter.

In the March number of the I.E.E. *Journal*, Prof. Miles Walker puts forward suggestions which, if followed up, may have results not less important than the Willans straight-line law. He points out that by spending £600 on a certain 20,000-kW generator, it is possible to reduce the loss by 40 kW. Now if one were to put this forward to the ordinary designer, he would look up in an abstracted way and say that on 20,000 kW, 40 kW is 0.2 per cent., and he would state that he could not see his way to alter the standard patterns to make a saving which one could not trace in a steam consumption test. True enough, one could not. Yet 40 kW, if saved for 4,000 hours per annum, would amount to 160,000 kWh, and that is worth saving! The upshot of the argument, then, is this: First of all, one should design a generator to give as good results as possible, on ordinary lines, and subsequently one should revise the design to make savings, even though they cannot be recognised on the percentage basis, savings which cannot be measured even on careful steam consumption tests. As Prof. Miles Walker points out, we must not let the desire to get the utmost out of the materials prevail too much over us. What we want is to get the utmost commercially, and that may even mean that we must work the materials at a point below their limit. This may have the additional advantage of making the generator more reliable, an important consideration.

Prof. Miles Walker's point is so weighty that one hopes it will speedily be recognised. One knows, of course, that designers, in large factories, are necessarily tied down by their shop practice, and one can hardly expect them to work out the problem whether 40 kW can be saved on a 20,000-kW set. This work should properly be done by men of Prof. Miles Walker's stamp. It is, indeed, just the kind of work that our colleges should encourage their technical staff to take

up, with benefit to everyone. A practice of this kind would also help the financial side of a professorship, besides keeping the holder of the position in touch with actual work.

One may add a word here on the choosing of professors for our colleges. The selecting committees sometimes think that they have done a good stroke in getting a man who has been a designer in a large works. While experience of this kind is invaluable, it is not enough. A professor should first of all be able to impart knowledge to the average student, a most difficult thing, be it said. The man who has been designing in a factory for many years may have a profound knowledge of a certain subject, but he may also be narrow, and incapable of understanding the student mind. He may even have become afflicted with the disease of keeping things secret, a disease not unknown in large factories, and that is fatal to good teaching. The man who has profound practical and theoretical knowledge, and who also can teach, is rare, but, when caught, everything should be done to keep his wits alive. A certain amount of consulting work on the above lines will act as an admirable stimulant, and the students will reap the benefit.

Foreign Patents and the Peace Treaty.

A CASE is reported which seems to show that those who drafted the Peace Treaty were not fully alive to the interests of persons in England who had made use of enemy patents. We refer to Cooksley *v.* Crowthorne Engineering Co., which came before Mr. Justice Peterson on June 29th. As our readers are aware, a patent lapses if the renewal fees are not paid. This accident happened to many German patents during the war, and English manufacturers, as they lawfully might, not unnaturally began to avail themselves of enemy property. It is obvious, however, that a patented article may be a thing of some complexity which cannot be made or perfected in some cases for many years. When the Peace Treaty was under consideration, as it was realised that patents belonging to Englishmen in Germany might have lapsed during the war, a clause was inserted giving the patentee the right to renew, but subject to the protection of the interests of those who had infringed between the date of the lapse and the date of the renewal. Rules have been made to carry this provision into effect, but as the facts of the case under consideration seem to show, they are not sufficiently wide to protect and indemnify a person against loss incurred owing to his reasonable belief that he was and would remain entitled to work the enemy patent. It appeared that on September 18th, 1917, a certain patent held by a German subject for a mortising machine lapsed, owing to the non-payment of renewal fees. An English company thereupon commenced to manufacture parts of the machines. It was provided, however (in effect), by a clause in the Peace Treaty, which came into force on July 31st, 1919, that within a year after the signing of that document a German subject might pay the renewal fees, and have his patent renewed, "but subject to such conditions as each Power may deem reasonably necessary for the protection of persons who have manufactured or made use of the subject matter of such property while the rights had lapsed." In March, 1920, the German patentee paid the renewal fees, and thereupon became entitled to his patent, subject to the rights of persons who had infringed since September, 1917. After the renewal of the patent, the defendants manufactured some parts and assembled 32 machines, mainly of the parts already in stock at the renewal date; the patent was for the combination. In these circumstances they were sued for infringement by or on behalf of the patentee. They relied on a "restoration order" dated March 20th, 1920, whereby it was provided that no action should be commenced in respect of the use or employment of any mechanism or the sale or use of any article in the United Kingdom made in infringement of the renewed letters patent "after September 18th, 1917, and before the date of this order." Mr. Justice Peterson, however, held that this did not protect the defendants, inasmuch as, the patent being for a combination, the use of that combination constituted an infringement of the patent, and that such user, after March 20th, 1920, could be restrained by injunction.

It appears to us that the learned judge arrived, or was compelled to arrive, at a somewhat harsh conclusion. Had the defendants known when they first began to manufacture parts of the patented article that their ultimate user in the finished machine might be prosecuted by the patentee, they would never have embarked upon the enterprise.

The Problem of Getting a Job.

THE difficulty of securing employment in industrial life after leaving it for a period is often brought home to us by letters which, though by no means despairing—our correspondents almost always retain a spirit of inexhaustible optimism and confidence in the future, we are glad to say—often tell a tale of persevering effort unrewarded by success, which makes us wish we had an unlimited number of vacancies to place at their disposal.

The question is particularly pressing in the case of ex-Service men, who before all ought to be installed in suitable situations. Many of them are highly skilled in electrical work, but cannot readily gain admission into a trade union except as "auxiliaries" or "improvers" at a low wage—if, indeed, they are lucky enough to secure a berth. For instance, one who writes us describes himself as having initiative, "conscientious, willing to be told, ambitious, and cheerful under all circumstances." Apart from technical qualifications, that is the sort of man that anyone would be glad to engage. Yet, somehow, it is surprisingly difficult for the would-be employé to find the willing employer. We can only hope that the period of depression through which the country is passing will soon give place to renewed activity, when everyone willing to work will find work waiting for him.

The I.M.E.A. Convention.

AFTER a variety of vicissitudes, unprecedented, we believe, in its history, the annual Convention of the Incorporated Municipal Electrical Association is to take place next week, in London. It is true that the function is called the annual meeting, and at first, when the Dundee Convention was abandoned, it was intended that the proceedings should be limited to the annual general meeting and the annual dinner; but apparently this was not agreeable to the members, and the programme has gradually been extended until it includes all the usual items except "visits to works and places of interest." It is, in fact, a severely professional meeting—during working hours; the members may be trusted to see that the tension is relaxed betweenwhiles, and if the Council's deliberations have shown a certain amount of indecision and "cut and try" that we have not hitherto associated with the I.M.E.A., we can congratulate both the Council and the members on arriving at last at a very satisfactory solution of the problem. Major Richardson, deprived by fate of the privilege of presiding over the Convention at home, has our sympathy and, we are sure, that of the Association as a whole; apart from that misfortune, we see no reason why the proceedings should be less profitable or less enjoyable than usual.

The papers deal with two subjects—the financial and commercial aspects of electricity supply, by Mr. C. W. Charlesworth and Mr. E. Cross, and boiler-house practice, by Mr. D. Wilson and Mr. W. M. Miles—questions which are in the forefront to-day, and should afford abundance of material for discussion. Incidentally, we inferred from the programme that the London and Home Counties Inquiry was expected to conclude by Wednesday next. We hope it will—but unfortunately a doubt has arisen, and the meetings may have to be held at the Institution of Mechanical Engineers.

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VISIT BY THE PRINCE OF WALES.

Brilliant weather prevailed last week when His Royal Highness the Prince of Wales, accompanied by Lord Derby and suite, toured Lancashire. He was received with enthusiasm and accorded a wonderful welcome wherever he went, and it is not surprising after the experience of the first day that the programme of the tour had to be modified. Certain visits to industrial establishments had to be omitted, and at Manchester on July 7th his tour of the Trafford Park Works of the Metropolitan-Vickers Electrical Co., Ltd., was materially curtailed.

Fig. 1.—H.R.H. The Prince of Wales Passing Through the Trafford Park Works.

Nevertheless, after luncheon on Thursday afternoon the Prince was received at the North Gate of the works by the directors of the company, represented by Capt. R. S. Hilton, managing director, and Col. Montague Cradock, C.B., C.M.G. Following the presentation of certain members of the managerial staff and members of the Stretford Urban District Council, in whose area the works are situated, the Prince inspected 1,300 ex-Service men who were lined up in charge of Lieut.-Col. Maxwell, D.S.O. On leaving the works, His Highness proceeded down the main avenue to the South Gate, fig. 1, passing the new Research Department building on the right, and recording the time of his visit by "clocking on" in the same way that his father, H.M. King George V, registered the time of his visit to the works in May, 1917.

The foundation stone of the company's works was laid in 1901; they are now amongst the largest of their kind in this country, the principal products comprising complete equipments of every description for the generation and application of electricity. The works occupy an area of 70 acres, 35 of which are roofed in, with canteen accommodation for mid-day meals for over 4,000 people. The number of men at present employed is 10,000, and that of employés who enlisted during the whole period of the war 3,522; 326 men made the supreme sacrifice, and 2,000 ex-Service men, including a large number of disabled, are at present employed in the works.

During the years 1914 to 1918 the company was extensively engaged on munition work. Shells from the 3.3-in. high-explosive up to the 15-in. howitzer type were made, besides Diesel engines for submarines, Ricardo engines for tanks, mines, paravanes, gun carriages, magnetos, time fuses, &c., to mention only a few items. In all 16,000 tons of war material of every description was produced. This was entirely apart from the normal manufactures of the company, which attained a total of 92,000 tons during this period, and were used almost exclusively for war purposes in munition factories and base depôts.

Conspicuous features of the organisation are the educational facilities provided for the various grades of apprentices employed, numbering about one thousand, and the large number of associations formed by the employés for mutual aid, instruction, or recreation. Sixteen such associations are now active. The War Relief Committee has collected a total of £71,900, and distributed a total of £55,200. The balance is being distributed to the widows and orphans still on the books at the rate of £50 per week. The Works Committee was inaugurated in January, 1917, by the company, and so anticipated the recommendations in the Whitley Report.

Over 100 truck loads of finished goods are dispatched from the works every month, and in addition to the Trafford Park works the company also has control of the electrical departments of the River Don works at Sheffield, and the works at Brimsdown, where the "Cosmos" lamps and heating and cooking appliances are manufactured.

The works at Trafford Park possess unusual facilities for transport by means of rail, canal or steamship. A new building has recently been completed which contains the warehouse and traffic department and also a works canteen, where 2,000 men can be accommodated simultaneously. At one end of the main machine shop is situated the firm's private power station, wherein turbines and gas engines drive generators delivering a total of 7,500 h.p., both d.c. and three-phase energy, for the various power requirements of the works. Adjacent to the site the company has purchased 55 acres of land for future developments, and within the space occupied by the works there are some 15 miles of standard railway track, which links up directly with the Manchester Ship Canal Co.'s system in Trafford Park and also with the Cheshire Lines Railway.

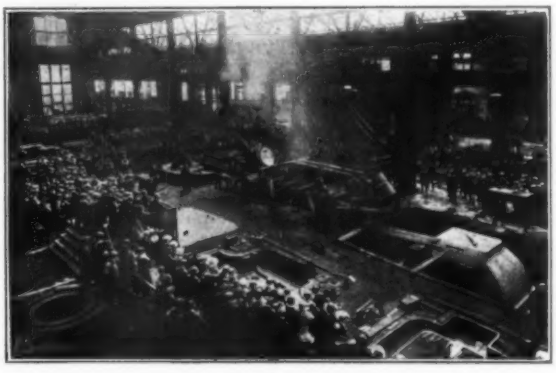

Fig. 2.—Making a 30-ton Casting in the Foundry.

A special staff of engineers is engaged upon the question of the standardisation of all parts that can be made interchangeable or common to more than one type of

apparatus, and one of the most interesting developments taking place at the present time is the erection and equipment of a block of buildings to be devoted entirely to research work. The buildings, which have been located as far away as possible from the noise and dirt of the works, consist of a two-storey office block, the ground floor of which will be used for administrative purposes and the first floor as a research library, together with three single-storey buildings specially designed and equipped for chemical, mechanical, physical and electrical research, one building being reserved entirely for testing different manufacturing processes on a small scale. Very careful consideration has been given to the

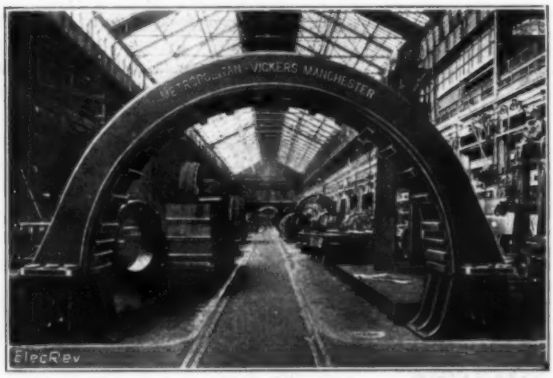

Fig. 3.—Stator of a Large Motor for Italy.

design and equipment of these buildings; each is designed on a unit basis and is easily capable of extension. At a later date a laboratory will be erected for carrying out investigation work on extra-high-pressure transmission, and will have a specially prepared outdoor area connected to it for research work on outdoor substations.

A large number of the employés have to travel considerable distances every day to and from home, and it will be readily appreciated that it is no small undertaking to provide catering facilities for such a large number of people. The canteen buildings include stores for vegetables, &c., and refrigerating plant. The ventilation and heating are carried out by means of the "plenum" system, which combines heating or cooling and ventilation and gives a complete change of air one and a half times per hour on the canteen floor, once an hour elsewhere in the building. Protection against fire is given by the sprinkler system, also employed in the works; lighting is effected by means of gasfilled Reflex pattern lamps, and electric cooking apparatus is employed.

Two well equipped ambulance rooms are also provided, one for men and one for women, in addition to the numerous first-aid stations throughout the works, together with a motor ambulance, and the company claims to have anticipated the advent of welfare work.

The Works Committee has done a great deal of useful service in providing a means for bringing workers into direct contact with the management. The successful work accomplished by this committee led to the formation of a Staff Committee conducted on similar lines. The foremen have also banded themselves together to form an association for their mutual benefit, and there is no doubt that the foremen themselves, as well as the management, realise that there are very great advantages to be obtained by the interchange of experience and ideas. The management meets the works officials and foremen at frequent and regular intervals for the purpose of discussing any suggestions which may be put forward.

Referring to the illustrations, fig. 1 is a view of the passage of the Prince of Wales through the works, while fig. 2 was reproduced from a photograph taken in the foundry as a 30-ton casting was being made for a 25,000-kW turbo-alternator set destined for the Manchester Corporation's power station now in course of erection at Barton; the cast was intended to be carried out by means of remote electrical control. Fig. 3 shows one half of a stator of one of the 1,200-h.p. a.c. motors which are being built for Italy, at the north end of the electrical erecting department. A similar arch was formed at the south end of the aisle. The inspection of the work passing through the shops proved of very great interest.

THREE-PHASE SUPPLY TO SCOTT-CONNECTED TRANSFORMER BANKS UNDER VARIOUS CONDITIONS OF TWO-PHASE LOADING.

By G. W. STUBBINGS.

In view of the increasing use of Scott-connected transformer banks for the supply of one-phase low-pressure networks from three-phase alternators, a discussion of the nature of the three-phase supply to such transformers under various conditions of two-phase demand is not without interest. In actual practice the two-phase side of Scott-

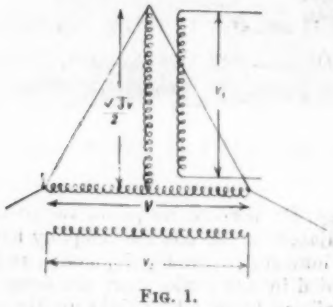

Fig. 1.

connected banks is rarely balanced, the currents usually being dissimilar in the two phases, and the power factors not always being identical. The writer gives below a simple investigation of some of the conditions of unbalancing that may be met with, in the hope that this may be of interest to engineers who have charge of Scott-connected transformer banks.

The elementary theory of the Scott connection is simple. Consider, in fig. 1, the primary of a transformer connected between phases B and C of a three-phase system. It is clear that, if V be the phase voltage, the pressure between phase A and the mid-point tapping on the transformer winding will

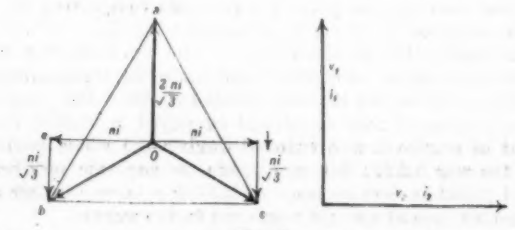

Fig. 2.

be $V \times \sqrt{3}/2$. If the primary of a second transformer, having $\sqrt{3}/2$ times the number of turns of the first, be connected to the points A and D, the potential of D will remain unaltered. If the secondaries of these transformers have an

equal number of turns, then the ratio of transformation in the transformer B C being n, its secondary voltage will be $n\,\text{V} = v$, and the ratio of the transformer A D will be $2\,n/\sqrt{3}$, and its secondary voltage will be $\text{V} \times \sqrt{3}/2 \times 2n/\sqrt{3} = n\,\text{V} = v$. The secondary voltages will be equal, and it is at once seen from the diagram that they will be in quadrature.

When equal currents, considered for the moment at unity power factor, are drawn from the two-phase side, the currents in the primary windings required to balance the magnetic effects of the secondary currents will be different. If each secondary current be i, the current in the primary of the transformer A D, or the teaser transformer, as it is often designated, will be $2\,n\,i/\sqrt{3}$. The current required in the primary winding of the main transformer B C to balance the secondary current will be $n\,i$. The vector diagram of these currents is given in fig. 2. The current in

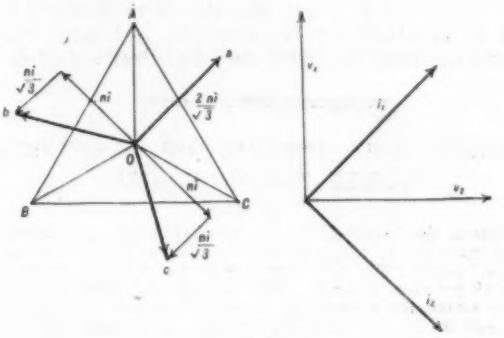

FIG. 3.

the teaser transformer is in phase with the star voltage O A. The current in the main transformer is the resultant of two components. The first component is $n\,i$ required to balance the secondary current. In addition to carrying this current, the main transformer forms a return path for the current in the teaser transformer primary, this current dividing into two halves at the mid-point tapping D, one half flowing in each direction. In fig. 2 $e\,b$ and $f\,c$ are the two halves of the teaser primary current, whilst the components e O and O f, being opposed both in phase and direction form a one-phase current through the transformer primary. It will be noticed that the components e O and O f are identical in phase, but flow in opposite directions from the mid-point. These components, therefore, produce no magnetic effect in the core of the transformer.

The currents in lines B and C are each $n\,i\,\sqrt{1 + \frac{1}{3}} = 2\,n\,i/\sqrt{3}$, the angle e O B is also clearly $\sin^{-1}\frac{1}{2}$ or 30°. The line currents are, therefore, equal and symmetrical for a balanced two-phase load at unity power factor.

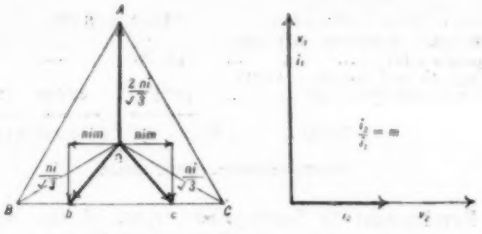

FIG. 4.

If the two-phase load remains balanced, but of a power factor less than unity, the vector diagram for the three-phase side is shown in fig. 3. The main transformer carries a current, it is seen, which is the resultant of that balancing the secondary current, and the two halves of the teaser primary current. It is readily seen that in these circumstances the three-phase supply is still balanced, and the phase angle on this side is the same as that on the two-phase side.

The fact that the main transformer carries the resultant of two separate currents has a bearing on the rating of the transformer bank. The power factor of the main transformer with balanced secondary load of unity power-factor is seen to be 0·866. For a given factor W in each phase on the secondary side, the kVA in the primary windings will be W (1 + 1/0·866). The ratio of the three-phase kVA to the two-phase power will be 2·15/2, or 1·07. The rating of the main transformer must be increased by 15 per cent. when used for Scott connection.

The case may now be considered of a secondary load of unity power-factor, but unbalanced in magnitude. Let the ratio of the load drawn from the main transformer to that drawn from the teaser transformer be m, m being less than 1. The vector diagram for this condition is given in fig. 4. It is evident from the diagram that the currents in lines B and C are each $n\,i\,\sqrt{m^2 + 1/3}$, whilst the phase angle of the current in these lines is $\tan^{-1}(1/\sqrt{3}\,m) - 30°$, being

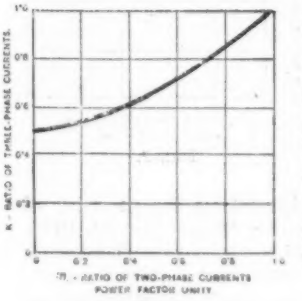

FIG. 5.

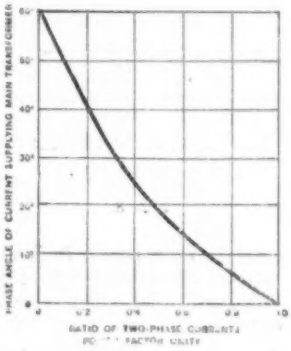

FIG. 6.

leading in line B and lagging in line C. A curve showing the ratio of the current in lines B and C to that in line A for various values of m is given in fig. 5, and fig. 6 shows the increase of phase angle as m diminishes from 1 to zero. The condition $m = 0$ corresponds to a single-phase load being drawn from the secondary of the bank, in which circumstances the load on the three-phase side must be single-phase only.

As a numerical illustration the case may be taken of the load on the main transformer being 0·4 of that on the teaser transformer. In these circumstances, the ratio of the currents in lines B and C to that in line A is 0·61, whilst the phase angle of these currents is about 25°—

$$\text{Two-phase power} = i\,v + 0{\cdot}4\,i\,v = 1{\cdot}4\,i\,v.$$

$$\text{Three-phase power} = \frac{2\,n\,i}{\sqrt{3}} \cdot \frac{v}{\sqrt{3}\,n} + 2 \times 0{\cdot}61 \times \frac{2\,n\,i}{\sqrt{\quad}} \times \frac{v}{\sqrt{3}\,n} \times \cos 25°$$

$$= \tfrac{2}{3}\,i\,v\,(1 + 1{\cdot}22 \,.\, \cos 25°) = 1{\cdot}4\,i\,v.$$

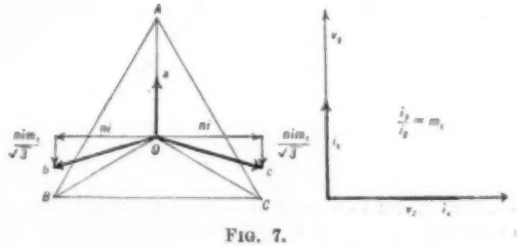

FIG. 7.

If the main transformer has the relatively greater load, the currents in the three-phase lines can be similarly worked out. A typical vector diagram is given in fig. 7. If m be the ratio of the smaller to the larger current on the secondary side, the ratio of the current in line A to those in lines B and C is now $2\sqrt{m_1^2}/(3 + m_1^2)$, while the phase angle of the current in lines B and C is $30 - \tan^{-1} m/\sqrt{3}$. Curves giving the ratios of the currents in line A to corresponding currents in lines B and C, and the phase angles of these latter currents for various values of m_1 are

shown in figs. 8 and 9. When $m_1 = 0$ the load on the three-phase side is single-phase, the line A supplying no current. From the foregoing it is seen that a better balance on the three-phase side for a given amount of two-phase unloading is obtained when the teaser transformer carries the heavier load.

If equal currents be drawn from each phase of the secondary, but these currents be of different power factor, the three-phase supply will no longer be balanced. Two typical cases are shown in figs. 10 and 11. The power factor of the phase supplying the lagging current is the same in each case. It is evident from the geometry of these diagrams that fig. 11 can be derived from fig. 10 by rotating the current vectors as a whole through an angle equal to the angle of lag considered, in a positive direction, and then by rotating the vector i_1 symmetrically about its voltage vector in a negative direction through twice this angle. This being so, it follows that the three-phase

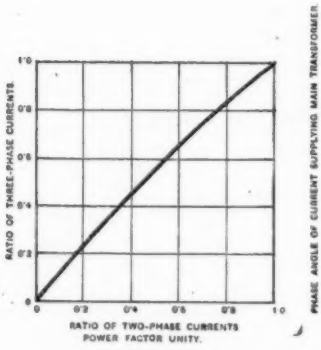

Fig. 8.

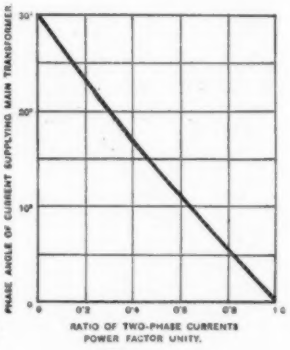

Fig. 9.

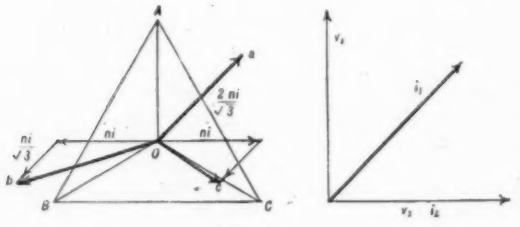

Fig. 10.

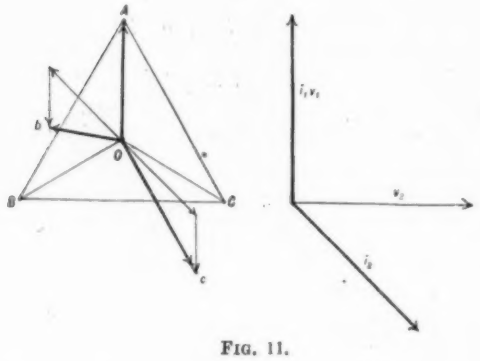

Fig. 11.

loading in the two cases is similar as regards magnitude, excepting that in fig. 11 line C carries the current that in fig. 10 is carried by line B. The magnitudes of the currents for typical cases are given in the following table :—

Equal currents on two-phase side.
One-phase unity power-factor.
One-phase power-factor cos ϕ.

	$\phi = 0$	$\phi = 30°$	$\phi = 45°$	$\phi = 60°$	$\phi = 90°$
Current in line A ...	$1{\cdot}15\,ni$	$1{\cdot}15\,ni$	$1{\cdot}15\,ni$	$1{\cdot}15\,ni$	$1{\cdot}15\,ni$
" " B ...	$1{\cdot}15\,ni$	$1{\cdot}38\,ni$	$1{\cdot}47\,ni$	$1{\cdot}53\,ni$	$1{\cdot}58\,ni$
" " C ...	$1{\cdot}15\,ni$	$0{\cdot}87\,ni$	$0{\cdot}72\,ni$	$0{\cdot}58\,ni$	$0{\cdot}43\,ni$

Cases in which there is out of balance on the two-phase side, both as regards magnitude of current and power factor, are complicated to calculate, and are best solved by graphical methods. A typical case is shown in fig. 12, in which the teaser is supplying one-half the full-load at unity power-factor, whilst the main transformer supplies full-load current at a power factor of 0·866.

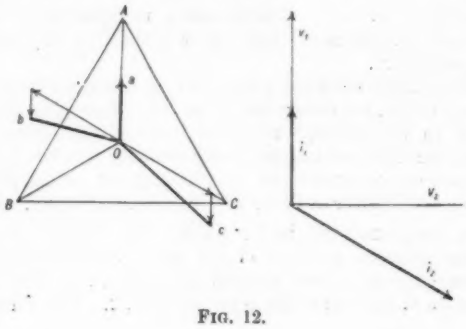

Fig. 12.

It may be well to repeat that the above discussion has been of an elementary character, and that magnetising currents and small disturbing causes have been neglected.

EXPORTS AND IMPORTS OF ELECTRICAL GOODS FOR JUNE, 1921.

Although the imports total for last month was only slightly below May's figure, a serious fall occurred in the total value of exported goods. The difference was over a million pounds, or about 46 per cent. decrease. This decrease was distributed fairly evenly among the constituent items, but exports of submarine cable fell by 92 per cent., but the May total under this head was much higher than usual. The only increases on the previous month's export values were in switchboards and meters. As regards imports, the chief increases were apparent in the cases of batteries, glow lamps, and telegraph and telephone instruments: decreases occurred in the values of insulated wire, electrical machinery, and arc lamps. There were no noteworthy changes in the re-export values.

Values of Electrical Exports and Imports for June, 1921.

	Exports.	Imports.	Re-exports
Electrical goods and apparatus (unenumerated)	£162,568	£49,134	£1,068
Insulated wire	228,055	7,570	404
Glow lamps	35,905	40,142	609
Switchboards (not telegraph or telephone)	19,999	2,749	—
Arc lamps and parts	2,572	200	—
Batteries	40,488	16,877	—
Meters	50,014	11,709	3,169
Carbons	1,672	13,415	2,154
Electrical machinery:—			
Railway and tramway motors ...	1,382	—	—
Other motors and generators ...	191,342	—	—
Electrical machinery (unenumerated)	138,063	51,463	712
Telegraph and telephone cable and material:—			
Telegraph and telephone wire and cable (not submarine) ...	115,342	8,153	—
Submarine telegraph and telephone cable	63,338	—	—
Telegraph and telephone instruments and apparatus	157,237	41,509	3,681
Totals... ...	£1,207,977	£242,922	£14,797

Development in Spain.—The report of the Sociedad Espanola de Construction Naval states that the new works at Reinosa have begun to supply to all the company's works special steels, forgings, and castings. Thanks to these works, the Carraca artillery works, and the Sestao engine and boiler works, which complement those of Ferrol and Cartagena, the company is now able to meet all its own requirements for the complete construction of ships of all kinds, war material, and railway material. To promote the latter class of work with responsible guarantees, the company has concluded agreements with foreign firms, as, for instance, the Metropolitan Wagon and Finance Co., and in agreement with other Spanish industries has secured contracts for wagons and other works for the Madrid Railway and other companies. Moreover, in order to be prepared to submit schemes and plans for the electrification of railways, the company has signed guarantee agreements with the American Westinghouse Co., the Metropolitan-Vickers Co., of Manchester, and Vickers, Ltd.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "R.M.R." Triode Valve and "Thermagnion."

An interesting demonstration of some new wireless developments was given by Messrs. R. M. Radio, Ltd., on June 23rd, at their engineers' offices, now situated at 5, Regent Square, W. 1.

The first exhibit was an entirely new form of triode (fig. 1), which has been designed to give an increased signal strength with the absence of the usual parasitic and microphonic noises. The anode and grid of this triode take the form of hemispheres, nested one within the other, with a substantially uniform gap between them. The filament is of tungsten wire, and is formed into the shape of a semi-circle, and so arranged that it is concentric with the other two electrodes.

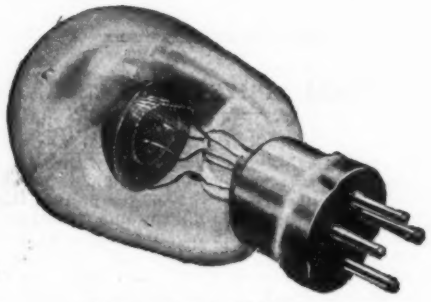

Fig. 1.—The "R.M.R." Triode.

The bulb is so exhausted that there is a slight trace of gas left, so that the triode functions as a soft valve. The superior results obtained with this form of triode are due to the particular construction of the two hemispherical electrodes and can be explained as follows:—

Electrons moving in the same direction and each possessing its own field of force, tend to mutual repulsion, so that in the ordinary cylindrical-anode type of triode a large proportion of the electron strain is diverted from this anode. In the case of the hemispherical anode there is a very marked increase in the discharge against the plate, the strays due to repulsion being reduced to a minimum.

Furthermore, the hollow rigid hemispherical form of grid has a natural mechanical period of vibration which is extremely short. In this way any vibration transmitted to the valve and thence to the grid is damped out immediately in the grid itself, and so does not give rise to objectionable microphonic noises so noticeable with the spiral wire form of grid.

The "Thermagnion" which was demonstrated is an entirely new method for magnifying signals, which operation has hitherto been accomplished by the aid of amplifiers and reaction circuits. In this case the simplest one-valve circuit is in no way altered, and the magnification is brought about by the action of a magnetic field exerted on the space occupied by the three electrodes of the soft "R.M.R." triode in such a manner that the positive ions can be controlled to advantage. By suitably adjusting the electricity and position of the field, it is possible to produce a magnification of the signals received in the anode circuit.

Another most interesting feature of the "Thermagnion" is that, by further adjustment of the field, it is possible to produce ionic oscillation in the triode itself, so that a heterodyne effect is obtained and C.W. signals are detected.

A new type of recorder was also shown. In this, relays are operated by the "over-balancing" of an arrangement similar to a Wheatstone bridge.

The "Bungalyte" Set.

Messrs. Arthur Lyon & Co., 36, Victoria Street, Westminster, S.W.1, have sent us details of their small "Bungalyte" lighting set recently placed upon the market.

This set, which is illustrated in fig. 2, consists of a small 4-stroke air-cooled petrol engine, direct coupled to a 300-watt, 24-volt generator, together with a battery, switchboard, oil tanks, &c. Working on full load, the engine consumes 1 gal. of petrol in ten hours. The dynamo is constructed with laminated fields, and is fitted with a cooling fan. The set is put into operation by a simple mechanical starter.

The battery consists of 12 glass cells capable of lighting six lamps for 10 hours without recharging. The set was designed with a view to portability (the portable type weighs only 55 lb.), and occupies a space of 20 in. by 18 in. by 10 in.

The accessories supplied with the set include everything necessary for a lighting installation such as cables, lamps, switches, blocks, and other fittings.

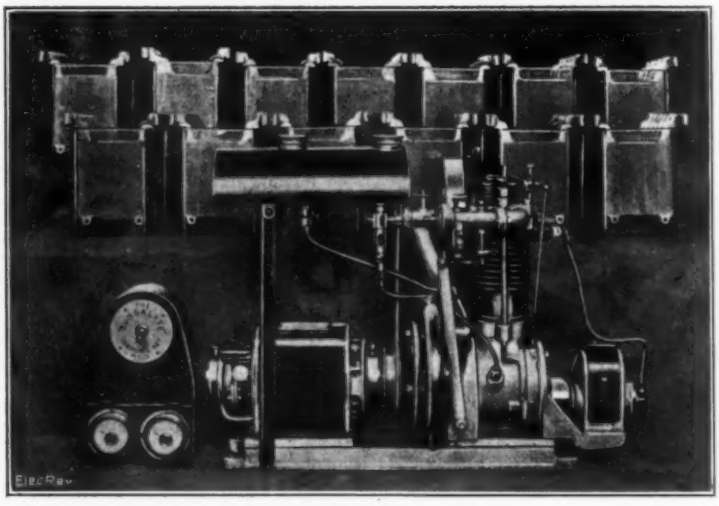

Fig. 2.—The "Bungalyte" Set.

An Improved Electric Lantern.

We have received from Messrs. Gabriel & Co., 4 and 5, A B Row, Birmingham, details of their improved electric lantern (fig. 3) which has been designed principally for the use of police and night watchmen. The light is provided by a 4-V, 4 c.p. lamp, energy for which is supplied by a "Bipol" battery capable of maintaining the light for 14 hours continuously. The case is made of tin or of "Clarus" aluminium alloy. A central combination switch is fitted in the top of the lantern, and in the middle of this is a tapping key for signalling purposes. A special feature of the lantern is a pair of contact sockets into which plugs can be inserted for charging purposes. These sockets can also be used to supply a small auxiliary lamp. The contact plate is of fibre, and is fitted with two contact springs on either side with a plate in the centre; it is arranged to carry a spare lamp bulb. A special focusing arrangement is embodied in the lantern. This consists of two telescopic tubes; the outer one has two slots cut in the top and bottom, and the inner tube bears two springs which fit into these slots. Focusing is effected by the movement of the knob seen in the illustration. The lantern weighs about 2 lb. A charging board is made by the firm to deal with 20 of these lanterns at a time. The board is fitted with a resistance, pilot lamp, voltmeter, ammeter, two-pole switch, fuse, and three terminals.

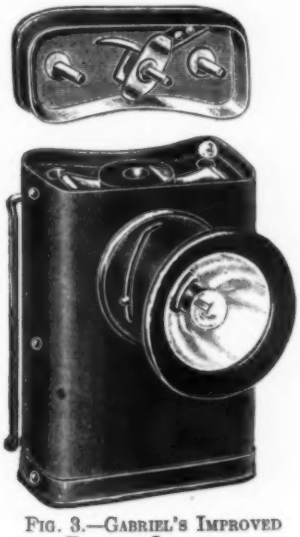

Fig. 3.—Gabriel's Improved Electric Lantern.

An Electric Egg Tester.

The Telephone & Microphone Co., Ltd., Throwley Road, Sutton, Surrey, have sent us particulars of their egg tester, illustrated in fig. 4, p. 80.

The case is made of solid oak, varnished and polished, 7½ in.

by 3¼ in. by 1¾ in. deep. The aperture for the egg is marked by three radium points, thus enabling testing to be carried on in the dark. The egg, when placed in position, automatically switches on the light, which allows both hands of

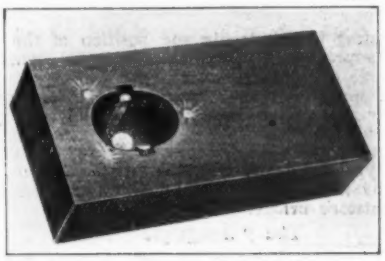

FIG. 4.—AN ELECTRIC EGG TESTER.

the operator to be free and the testing to be done with great rapidity. The lamp is attached to the base of the case, the current being supplied by an ordinary flash lamp battery.

HYDRO-ELECTRIC PROBLEMS IN SCANDINAVIA.

THE annual conference of the Swedish Hydro-Electric Association (Vatten Kraft Forening) was recently held at Stockholm, when Mr. Dahlander, in declaring the proceedings open, stated that during the critical times of the war the Swedes had learned how to appreciate the value of their water power. The time of high coal prices, however, was past, and it was, therefore, of special importance to reduce the costs of erecting hydro-electric works.

Mr. Sven Lubeck then read a paper on water-power questions in 1921. He said that the rapid development of the unfavourable situation of trade had also impressed its mark on water-power conditions in Sweden. Notwithstanding the great demand for water power which was evoked by the scarcity of coal during the critical years, the more extended utilisation of waterfalls was only forced where special reasons existed for doing so. This was due to the rapidly growing cost of buildings and of machinery. The author stated that at the close of 1920 the plant installed in hydro-electric works in Sweden represented about 1,200,000 h.p., while works for a further 360,000 h.p. were in course of construction, of which 235,000 h.p. was for the State and 125,000 h.p. for private owners. These works included the State works at Motala, the Porjus extension, and the Bergslags power station which were approaching completion, whereas the works at Lanfossen for the Sandviks Ironworks, and Harsprang, had only progressed to an inconsiderable extent. The ironworks company had applied for an extension of time for the completion of the works in order to be able to do so at a more reasonable outlay, but the Board of Trade had opposed the application for the reason, among others, that by being compelled to construct quickly the company would be prevented from making a profit arising from the situation. Such an argument was actually brought forward, the author remarked, at a time when similar works for State account were for well-known reasons being restricted or suspended. Thus Parliament had decided that the preparatory works at Harsprang were to be completed and the remainder discontinued. Yet it had been proposed to base an electro-chemical industry on the power of the Harsprang works, but this was deemed to be hopeless in the face of foreign competition, having regard to the cost of completing the Harsprang works and the resulting price for energy, the cost of other raw materials and the labour difficulties.

Major H. Johansen, of Christiania, who introduced the subject of inter-Scandinavian transmission of power, pointed out that according to estimates, Norway possessed a water power capacity of 15,000,000 h.p., which would not only meet the requirements of the country itself, but would also permit of the export of a considerable amount of energy to neighbouring countries. By means of tables prepared from his own calculations, the author showed that the price of power imported into adjoining countries from Norway would be as low as 3 ore per kWh, as compared with the present Swedish sale price of about 5 ore per kWh. Direct advantages would be derived by Swedish industries through the import of power from Norway because the industries were dependent in a great measure upon the imports of coal, which were frequently uncertain. The requirements of Denmark could also be met by Norway; Sweden would need all her power resources for herself, and would have no surplus to export.

Mr. B. Borgquist, who dealt with the same question from the Swedish point of view, expressed the opinion, having regard to the long distance of transmission—750 kilometres from Hardangerfjord-Sweden-Copenhagen, that such a line would not prove to be remunerative until a considerably greater load was obtainable than could be procured at the present time. If consideration were also given to the risks which were incidental to the starting of new works on account of the deflation now in progress, it could be foreseen with great probability that transmission from Norway via Sweden to Denmark would not be brought about for a long period, probably ten years.

The author submitted that there were no opposing factors of practical importance as between Norwegian and Swedish interests concerning transmission to Denmark. Some surplus power was already being supplied by the Southern Swedish Power Co. to Zealand, and it would be possible to deliver power to a greater extent if the main line from Trollehattan were carried down to Skane, but that would have to be postponed owing to the present high cost. In general, the power produced in South and Central Sweden was cheaper than Norwegian, which would have to bear the cost of transmission.

Mr. A. S. Faber, of Copenhagen, discussed the problem from the Danish point of view, and said that a transmission undertaking in Norway would be self-supporting if the sale price of electricity delivered in Denmark could compete with that of coal and other fuels.

THE NATIONAL PHYSICAL LABORATORY.

(*Concluded from page 67*).

Electricity Department.—Electrical Standards.—Mr. F. E. Smith (now director of scientific research and experiment to the Admiralty) is of the opinion that at the present time the ohm and the ampere, which are the two fundamental electrical units, can be realised with as great an accuracy as the international ohm (by means of mercury columns) and the international ampere (by means of the silver voltameter), and he urges therefore that the time is opportune to revert to the ideal of 1863 and measure all electrical quantities in C.G.S. units. It is now possible to measure resistance, current, and voltage with a precision greater than is required by industry, and unless all values are stated within the limits of accuracy of measurement (not comparison) difficulties will certainly arise in the future. As an instance, it is possible at the present time by means of capacities and inductances to measure the frequency of a tuning fork, but unless the electrical quantities are in C.G.S. measure the frequency does not agree with that calculated from a direct measurement of the number of vibrations in a given time.

The Schuster magnetometer is practically finished, and measurements of the horizontal magnetic intensity will be made in the near future. To make the instrument an absolute one it might be modified so as to include an interior swinging coil; in this way the current could be measured. A design for a vertical force magnetograph has also been prepared.

General Electrical Measurements.—Some investigations on new magnet steel have been made and valuable results obtained. A new simple method has been tried for measuring effective permeability and energy losses in thin sheet-iron at radio frequencies. It consists in making up the thin iron rings into an inductance of toroid form with a single layer winding. The effective inductance and resistance of this wound ring are then measured by insertion in a wavemeter. Corrections for effective inductance of the winding without iron are small and easily made, and the accuracy of the method is within about 1 per cent. for permeability and a few per cent. for losses. A duplicate of the apparatus for magnetic testing has been installed which will allow magnetic research to proceed simultaneously with the test work.

A new method for measuring the effective inductance of four terminal resistances has been investigated which is of greater range than those developed by Campbell, but similar in principle. By comparison with a standard whose effective inductance was calculable, it was found that with a 1 ohm resistance the inductance could be determined to the nearest 0.01 microhenry.

A new method of measuring the capacity of condensers in terms of mutual inductance and resistance was found successful. It avoids the double "kick" obtained with the Carey-Foster method on the ballistic galvanometer; the method does, however, involve comparison of two practically equal throws. The accuracy is about 5 in 10,000.

Regarding wireless standards, an accurate comparison of the standard wavemeter has been made against the Abraham Bloch "multibrator." This apparatus produces a very peaky wave by means of three-electrode valves. Every harmonic from the 40th to the 150th can be picked out by the standard wavemeter. The average agreement over the range (2,000-7,500 metres), using a number of different inductances, was 1 in 10,000, and a report has been made to the Admiralty and will be published in detail shortly.

A new type of variable air condenser is being constructed which, it is hoped, will be an advance on any condenser yet made, from the point of view of permanence and accuracy. Amber insulation is provided, and the condenser will have a range up to 5,000 mmfd. Conjointly a standard self-inductance coil of 20 millihenries has been designed which will have spaced windings to reduce effective resistance and self-capacity. The design is such as to ensure constancy also. These two

pieces of standard apparatus will increase the range of the standard wavemeter to 20,000 metres.

A satisfactory method of measuring at radio frequency the high resistances used in connection with radio amplifiers consists in first shunting the condenser of a tuned wavemeter with the unknown resistance. Observation of the maximum current is made, and the high resistance is then removed and a fine low-resistance wire is inserted in series with the wavemeter and adjusted until the same current is obtained at resonance. Retuning of the condenser may be necessary on account of the capacity of the resistance. When equality of current in the two cases is obtained $S=L/CR$, where S=high resistance; L=inductance of wavemeter coil; C=capacity of wavemeter condenser; R=added equivalent series resistance, and the accuracy of the method is probably within a few per cent.

Apparatus has been installed for the investigation of the characteristics of thermionic valves, and mercury condensation pumps for the exhausting of the valves indicated vacuum pressures of one or two hundredths of a bar (1 bar=0.00075 mm. of mercury). The gauges available, however, do not allow of accurate measurements being made at such a pressure, and an associated investigation is in progress into other methods of measuring extremely low pressures. Valves of the standard types are being carefully measured for characteristics, when filled with various gases at different internal pressures. A research is also in progress into the use of silica in place of glass for the envelope and internal mounting of thermionic valves. The silica bulb will enable it to be raised to a much higher temperature during exhaustion, thus facilitating the elimination of occluded gases and the obtaining of a higher and more permanent vacuum.

Electrotechnics.—Since the a.c. work of a routine character has been very large, little opportunity has been available for special research work. Much of the work, however, is of a research nature. The number of instruments used for acceptance tests of steam turbo-generators continues to increase steadily, and the capacity of the plant for generating the alternating currents and voltages required has been outstripped by the progress of modern electrical engineering. Taking the work on tests of instruments used on steam economy trials of turbo-generators alone, these are now being carried out at a rate of about 100,000 kW a year, while similar tests for other than steam trials amount to practically the same figure.

There has been little opportunity to make a serious beginning on the research on the design of instrument transformers. Mr. Spilsbury has devised a new method of carrying out measurements of this nature, by which much higher accuracy in the measurement of small-phase angles, and of the departure of current transformers from the nominal ratio of primary to secondary current, can be obtained. The method is to use a high-ratio transformer to magnify the departure from perfection, using an electrostatic wattmeter as the indicating instrument. Incidentally the method has demonstrated how important stray magnetic fields are when large currents are used. When placed several feet away from such currents the high-ratio transformer may give quite an appreciable voltage in the secondary without the primary circuit being in use. For tests of this nature the transformer is turned round until the effect disappears. A lengthy series of tests by this method on a special current transformer of the highest quality showed incidentally that the small residual inductances of the standard tubular water-cooled resistances corresponded very closely with the calculated values. Work of this nature gives added importance to the reduction of the inductance of resistances for very large currents to the lowest practicable value.

In furtherance of the advancement of British electrical instruments, especially in foreign countries, the British Electrical and Allied Manufacturers' Association issued a joint publication, descriptive of the capabilities of apparatus made by its members, which was compiled by Dr. Rayner in order to give it the advantage of the experience and impartiality which might be obtained from its association with the Laboratory.

The experience of the staff has been much in request in relation to the work of the British Engineering Standards Association and the Electrical Research Association, and most of this work has fallen to Dr. Rayner. The work has included the drafting of specifications for several varieties of switchgear, the consideration of nomenclature and symbols, and the wave form of a.c. plant, especially from the point of view of avoiding interference with telegraph and telephone communication. The qualities required of oils to be used in insulating electrical plant, such as transformers and switches, have been among the subjects on which assistance has been given to the Electrical Research Association. Dr. Rayner has been chairman of a committee set up to draft a specification for such oils, which is practically finished.

Other committees on which work has begun deal with mica and porcelain. A special joint sub-committee to consider dielectric losses has been formed, and its present aim is to develop standard methods of testing materials at all frequencies used in the applications of electricity from 25 to 1,000,000 periods per second.

Regarding d.c. work, the further programme relating to the buried cables research is being proceeded with, and the information obtained at various times with cables of all kinds has been used to supply to the Wiring Rules Committee of the Institution of Electrical Engineers complete tables of permissible currents for concentric and three-core l.p. cables used for distribution in buildings. Similar information to meet the special requirements of ship's wiring is now being supplied to the Admiralty. A special investigation has been carried out for the British Aluminium Co. regarding the contact resistance of clamped and bolted joints in aluminium busbars, and also the heating with current of bars and rods of various sizes and sections. Interesting results have been obtained, in particular, with regard to the proper conditions under which a satisfactory joint can be made with aluminium, and a formula was evolved which allows of the pre-determination of the resistance of joints of a given thickness, overlap and contact pressure. Tests have also been made with copper busbars and some switch contacts.

In the photometry section the provision of sub-standards for measurements of gasfilled lamps is still urgent, and the most promising line of approach seems to lie in the direction of a blue glass combination with a vacuum sub-standard. Early in the year the Board of Trade set up a committee to consider the improvement of the regulations dealing with ships' navigation lights, and a large amount of work has been done at the laboratory for the committee. One of the subjects has been the spectral transmission of coloured glasses with the object of attaining greater uniformity of practice and a more satisfactory glass for the starboard light. A design is being prepared for a suitable form of lens for the side and masthead lights.

An extended investigation of the candle-power of existing types of miners' lamps has been undertaken at the request of the Home Office Committee on this subject.

At the request of the Ministry of Transport, a number of motor car headlights, fitted with various devices for the reduction of glare, has been examined at the Laboratory. The method adopted has been that of measurement of illumination distribution along selected lines on a screen placed 72 ft. from the headlight.

At the request of the Director of H.M. Office of Works, the Laboratory has given assistance with regard to certain details of a design got out to suit the special conditions of the lighting of one of the galleries of the National Gallery. The principal objects of the research were to secure adequate illumination on the walls, while avoiding direct sunlight, and to diminish as far as possible reflections of objects and people in the glass covering the pictures. The arrangement evolved for a gallery running E. and W. has a ceiling covering the middle third of the room. Direct sunlight is kept off the pictures on the N. wall by a vertical screen placed outside over the ceiling. By making this of a suitable size and white on the N. side so as to reflect the light from the N. part of the sky, the illumination of the N. and S. walls can be rendered equal for practically all conditions of weather. The scheme avoids direct top light, which illuminates the people, and makes the reflections in the glazing of the pictures very troublesome. At the same time the sensation of glare is much diminished. For a gallery whose length is N. and S. a series of transverse screens is used to keep direct sunlight from falling on the walls.

The assistance of the Laboratory has also been requested by the Office of Works in the matter of the artificial illumination of the Houses of Parliament and public buildings.

The galvanometers, formerly working with Nernst spot lamps, have all been refitted with metal-filament gasfilled lamps which work at 10 volts 3 amps. The energy is furnished from a temporary a.c. supply run round the rooms, the step down from 100 to 10 volts being effected by transformers made in the department.

A satisfactory substitute has been found for Nernst galvanometer lamps in the form of lamp used for the Aldis daylight signalling lamp. This is a gasfilled bulb of 50-mm. diameter containing a double spiral filament capped with an ordinary Edison screw cap, and rated at 10 volts and approximately 2½ amperes. The bulb is filled with argon and the lamp is intended to burn upright, though there is no reason to suppose that it will not burn satisfactorily in other positions if necessary. Its life at 10 volts exceeds 1,000 hours. With a lens of 8-in. focus and a galvanometer mirror of 3 metres radius, the "spot" has a brightness of over 1 foot-candle. If two or more of these lamps are used in series for economy of current, it is necessary to select them carefully, as these lamps vary considerably in current rating at the same voltage.

Meterology Department.—An investigation into the dimensions of Edison threads for lamp holders and caps has been undertaken for the British Engineering Standards Association. The object of the research is to find an international system of dimensions for lamp holders and caps of Goliath and ordinary sizes which can be adopted with reasonable degree of interchangeability between parts made to the new dimensions and those made to the existing American and Verband Deutscher Elektrotechniker systems.

Two "quiet" electro-magnetic clock units, for silent and balanced step-by-step driving or synchronising mechanism were examined and reported upon for the patentee, Capt. Craig, of Haslemere. This is a very ingenious arrangement, silent in action, and applicable for every second, or any agreed number of seconds. The question of the provision of a more satisfactory type of electric contact on the standard clock, to replace the mercurial one hitherto used, has been under

consideration for some time, and the form finally decided upon has been in use for several months with satisfactory results. It consists of a phosphor-bronze wire bent in a semi-circle and attached to the Invar pendulum rod, to the two horns of which a strip of platinum foil is fixed in tension. The system is pivoted, and moves in a vertical plane, the amount of drop being controlled by a detent. Below it a "gold" watch balance-wheel is fixed on a small adjustable carriage. As the platinum strip is carried to and fro by the pendulum it brushes over a small segment of the balance wheel, thus making a contact, the duration and intensity of which can be closely adjusted.

A "wireless" receiving and recording apparatus has been fitted up in the clock room, and will be a valuable additional help in determining the daily rates of the reference standard clocks.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

E.L.M.A. and Retrospective Lamp Rebates.

Ever since the Osram lamp was put on the market I have been a wholesale lamp factor to the trade, and although in a comparatively small way, my turnover for each of the last two years has been £6,000, entitling me to a rebate of 36 per cent.

To-day I notice that one of my user customers is graded for the ensuing year at 34 per cent., his previous grading being 28 per cent., and his purchases from me last year £1,800 net.

I have no grievance in so far as the new grading is concerned. It is, however, concerning the system of allowing retrospective rebates that I complain, because in the case referred to, a credit will have to be sent for the difference between 28 per cent. and 32 per cent. on last year's turnover of £1,800, which at 4 per cent. on the gross price of the lamps will mean exactly £100.

The same thing arises every year, but it seems unfair that a trader should be called upon to give back, as in this case, what represents nearly the whole of the profits made during the period referred to.

Perhaps the E.L.M.A. will recognise the hardship this causes, and perhaps also it may see its way to remedy this grievance, because in such cases a trader scarcely knows how he stands at the end of his financial year, nor can he possibly know what his annual net profits may be so long as this system of retrospective rebates is allowed to prevail.

Paratus.

July 5th, 1921.

Short-range Sea Horizons for Cable Ships.

During a recent voyage of the Telegraph Construction and Maintenance Co.'s cable ship *Colonia*, I carried out some very successful experiments with short-range sea horizons which I venture to think will be of interest.

In these experiments I was very ably assisted by the navigating officers.

It is well known that at night the horizon, except under very exceptional circumstances, cannot be used for obtaining positions, but by using a calcium light as a short-range sea horizon at a known distance, and manœuvring the ship so as to get the required star vertically over this light, the altitude can be obtained. This operation repeated with two or more stars will give a very acurate positicon. In doing this it is best to use port helm, so that the calcium light comes in the clear glass of the sextant before being under the vertical direction of the star. Likewise, in the daytime accurate results can be obtained by a calcium light or a cask with a required interval between observations.

Although similar observations have been attempted before in daylight, the subject does not seem to have been taken up with regard to obtaining positions at night. Owing to the uncertainty of the ordinary sea horizon, the above method should overcome many difficulties.

When the sky is covered with cloud, which is frequently the case, it is impossible to obtain a star position at p.m. twilight, but the stars often show through a few hours later, and as by that time, the sea horizon has become invisible, excepting perhaps during a favourable moon, observation is still impossible. If by my suggested method a short-range sea horizon is arranged, then, at any time during the night, observations can be taken and position defined, provided that known stars are visible.

I am, therefore, inclined to think that with regard to cable-laying and repairing ships, this method may be of considerable importance.

I am hoping in the near future to have constructed a projectile flare to be thrown from a suitable gun to a known distance in any direction, so that at times when the sea horizon cannot be depended upon, or at night time, accurate positions can be got without actually stopping the ship or altering course, provided the weather is moderately fine.

My experiments were facilitated by a dip table which has been recently published by Mr. Percy H. L. Davis, late of the Nautical Almanac Office, for the purpose of the correction of altitudes at given distances in yards for use with short-range found sea horizons. I understand that this table will be included in Inman's Nautical Tables.

Victor Campos,
Master, Cable Ship "Colonia."

June 24th, 1921.

A Mysterious Occurrence.

On a small mixed lighting and power plant, 220 volts d.c., two 220-volt lamps of 16 c.p. with carbon filaments, wired in series, with the middle point earthed, are used for earth detection.

Quite frequently one or the other of the lamps bursts with a loud report, and the fuse in circuit with the lamps blows.

On replacing with new lamp and fuse, both lamps give half light as normal.

The question which puzzles me is why the lamp should burst, as at most it only gets 220 volts and is a 220-volt lamp.

A. H.

July 5th, 1921.

Armature Core Bands.

With reference to "Armature's" letter on armature core bands, it is not stated whether he sweated up the bandings with clips of tinned copper, the solder being run in all round the wires on each band.

If not, I am confident that this will prove satisfactory provided the armature is balanced for absolutely steady running, which is very essential with high-speed machines.

With regard to the copper clips, there should be from four to six clips for each band on armatures up to half a metre diameter, and on larger armatures one clip for about every 25 c.m. of periphery.

G. E. W.

July 4th, 1921.

Abnormal Meter Records.

We have noted with great interest the letter from your correspondent, Mr. R. Forrest Preston.

The explanation is not difficult to see, but we think it might be interesting to your readers if a little competition were established. We are prepared to give a small prize to the sender of the first solution received.

We hope you will be good enough to insert this letter, because otherwise the publication of the letter as it stands is calculated to damage the reputation of the Ferranti meter.

Ferranti Limited,
R. H. SCHOFIELD,
Sales Manager.

Hollinwood.
July 11th, 1921.

Sawdust as Fuel.

The sawdust and wood-refuse burning plant to which you refer in your editorial reply to Mr. Schneidau, as carried out under my instructions, is part of the plant of a large saw and wood conversion mill in England, operated by steam power, the steam being provided by burning the wood refuse.

I employed a modified method in two other saw mills, one in England and one in Burmah. If Mr. Schneidau will say how much sawdust he has to dispose of per day or week, and whether it is available as in the case of a saw-mill producing it by machinery operated by steam power, it might be possible to suggest a suitable means of utilising it.

W. Worby Beaumont.

London.
July 11th, 1921.

Charges for Service Mains.

With regard to "Disgusted's" letter in your issue of July 8th, respecting charges for service mains, this is only one of the many annoyances we wiring contractors have to put up with. The reason of the charge is the high cost of material, &c., at present, and the idea that if our clients can afford to have an electrical installation carried out in these times they can afford the extra expense. I, personally, have lost a good many contracts through these charges.

It has been said many times that the use of electricity is in its infancy, and according to the present rate of progress of electrical distribution in this part of the country it will be another century before we get going at all. The well-to-do classes recognise electric lighting, &c., as a necessity, while the working classes, who would be most benefited by it, regard it as a luxury because it is not available. There is more revenue waiting for the supply companies in 100 feet of frontage of working-class property than they will get from a similar

frontage of higher-class property, as the average frontage is 15 feet, two or more families live in one house, rooms are dark, and washing is done at home. The working-class people are the same people who have built up the big multiple-shop concerns, and will do the same for the electricity supply undertaking which will tackle the problem in the right way and cater for them. Of course, there are difficulties in the way, and we cannot think that the gas companies had roses from the start.

The electrical industry in this country seems to be fast asleep, from which it can be assumed that it pays large interests to let it sleep.

Controversies are waged over systems of distribution, methods of interior wiring, pressures of supply, whether a.c. or d.c., and, if a.c., phase and periodicity. No attempt is made to grade classes of interior wiring, or the workmen either, or to standardise accessories or other fittings. We allow other trades to retail electrical goods, while we fail to get the goods of other trades allied to our own at trade terms.

We also allow the newest part of the electrical industry, wireless telegraphy and telephony, to pass into the hands of the Government and its progress to be retarded for years.

In the electrical world there does not seem to be any team work, and it is time we woke up and started business. I have various suggestions to offer to help achieve this, which your readers will no doubt be able to improve on.

J. A. G.

London, N.W.
July 11th, 1921.

LEGAL.

WESTON ELECTRIC LAMP CO. *v.* STREET.

AT the Shoreditch County Court on Friday, before Judge Cluer, the Weston Electric Lamp Co., of 1-3, Sun Street, Finsbury, E.C., sued Mr. Street, of 128, Hill Street, Peckham, dealer in electrical lamps and fittings, for £5 3s. 6d., for goods supplied. Mr. Cripwell appeared on behalf of the plaintiffs. The delivery was proved to Alfred Street, and the man who had been served with the summons said he was that individual. He admitted the signature, but said the goods had nothing to do with him, but were for his son's business. His son was aged 22 years, and dealt in electrical goods, using the front window of his (defendant's) shop to show them off. Defendant was a hairdresser, and always had been, and he knew nothing about electric lamps and bulbs.

Judge CLUER: I see the customer's signature to the order is "B. Street."

Defendant: That is my son. I am a hairdresser, and don't understand the goods.

Mr. CRIPWELL: But you have served customers with them.

DEFENDANT: I might have done if my son was away.

In further answers defendant said he did not know exactly where his son lived, but he used the Peckham address. He was sometimes away for months. Certainly he was at home on Sunday, but he did not know where he lived.

Judge CLUER: That is the answer of a hairdresser, and not an honest man. He might just as well say he does not know where a twenty-month-old baby lives because it is out in the pram. (Laughter.)

Continuing, the defendant said that so far as he was concerned, he had nothing to do with the goods, and none of them had been used in his business.

Judge CLUER said it was evident they had got hold of the wrong man, so the summons would have to be dismissed against this defendant, with costs, and it would have to be re-served on the son.

The father promised to do his best to get the son's address.

RIO TINTO CO., LTD., *v.* BROWN, BOVERI & CO.

As briefly reported in our last issue, in the Commercial Court of the King's Bench Division on July 5th, Mr. Justice Bailhache began the hearing of an important action for damages for alleged breach of contract brought by plaintiff company against defendants, the action relating to the construction of an electric railway in Spain by the defendant company for the plaintiffs.

Sir John Simon, K.C., Mr. R. A. Wright, K.C., and Mr. F. Baber appeared for the plaintiffs. Mr. Douglas Hogg, K.C., Mr. Eustace Hills, K.C., and Mr. W. A. Jowitt represented the defendants.

Sir JOHN SIMON, in opening the case, said the defendants carried on business at Baden, Switzerland. The subject matter of the contract between the parties was the supply, erection and handing over in full working order of all the material and plant needed for working the traffic on a railway which the Rio Tinto Co. had between their mines at Rio Tinto, in the South of Spain, and the port of Huelva, about 50 miles. This railway was extensively used both for mineral traffic and certain kinds of passenger traffic, and it had hitherto been worked by steam.

The question in the case was primarily whether, as the plaintiffs alleged, the contract survived and had been repudiated by the defendants. The defendants, on their side, said that first of all the people who repudiated were not themselves but the plaintiffs. Then they set up the further defence that the contract had in the circumstances become frustrated by supervening illegality. They suggested illegality by Swiss law, inasmuch as they said that the Swiss law or the operation of the law prohibited the export of machinery and plant of this kind, to which the short answer was that it only did so subject to provisions for licences, and as a matter of fact there was abundant export by this company of this particular plant. Secondly, the defendants suggested supervening illegality by English law, viz., the illegality of the plaintiff company paying anything to the Swiss company if the latter was getting any of its supplies from Germany or Austria—to which the answer was that a very small portion of the whole would come under this stipulation, and in any event, the Rio Tinto Co. was in a position to get the necessary licence supposing that the defendants had been in a position to fulfil their obligations. The Rio Tinto Co. was a company which played an extremely important part in connection with the munitions output in the war, and had been in the closest relations with our own fighting departments, and the authorities here were very anxious to facilitate in every possible way the output of the Rio Tinto Co., for it was by that company's output that the sulphuric acid for the manufacture of high explosives was produced in the necessary quantities.

There was a further defence suggesting that the contract was in some way put an end to by *force majeure*, to which the answer was that there was not a *force majeure* clause in the contract. As a last resource, the defendants brought in a reference to the Courts Emergency Powers Act for relief.

The contract was dated July 3rd, 1914. There were two turbo generators, and they were in fact manufactured. What was rather surprising was that having manufactured them the defendants disposed of them to other purchasers in preference to the plaintiffs. There was equipment for six substations, each containing two transformers. There were to be two complete three-phase transmission lines, complete overhead trolley line equipment, and 12 electric locomotives, and these things were to be supplied and erected in full working order so that the plaintiffs would have a properly equipped electric railway. There were certain things that the Rio Tinto were to do, such as to erect the buildings necessary to contain the electrical plant. These things they had done, and spent some £20,000 in making preparations to receive this plant.

The defendants in Switzerland had made nearly all the plant. They had performed their part of the contract as far as the construction of these things was concerned, but instead of supplying them and putting them up in Spain, they had sold them to other people. The contract price for the work was £153,000 sterling, which was to include delivery alongside the plaintiff company's pier and the complete erection. The contractors undertook completely to deliver up the whole plant so that it was ready for working within 18 months of the date of the contract. That would carry them to the early part of 1916. There was a penalty clause of £400 penalty a week. Also there was to be attached to the contract a list of firms to whom the contractors might sublet part of the work, but they were not to sublet to other firms without the consent of the company. The only reference to *force majeure* began by saying the contractor took the risk of executing the contract, and said it was understood the contractor should not be liable for any damages due to *force majeure*. Also, the contractors appointed Brown, Boveri & Co., of Caxton House, Westminster, as their agents.

For some time, counsel went on, the defendants treated this contract as a thing they were dealing with and pursuing, but the scene changed in the early part of 1916, when they found themselves overwhelmed with orders from other quarters. It was not true that the plaintiffs repudiated the contract, or that the contract had collapsed or been brought to an end by the circumstances of the war. The truth was that down to 1916 the parties were treating themselves as contractually bound to one another. Then it suited the defendants to treat the plaintiffs as people with whom they had no contract, and they rapidly assumed that position.

His LORDSHIP: When do you say the contract was completely broken?

COUNSEL replied that defendants put it on record that they treated the contract as completely broken by letters in 1919. But in 1916 they were taking up the position that they were only prepared to deal with this contract upon the basis that they were given new terms and new prices.

Evidence was then given.

Mr. HOGG, for the defence, submitted that there was no case for him to answer. First of all, this was a pre-war contract. Secondly, it was a contract which by its terms contemplated that some of the work would be sub-contracted, and of course it was manifest that some of the work would be contracted with Germany and Austria. Thirdly, when the defendants told the plaintiffs in terms that the contractors whom the former proposed to employ included not only a very large number of Germans, but with regard to some items, nothing but them, the plaintiffs replied that the defendants were perfectly at liberty to do it. So that from that date they had an express agreement that defendants might supply German material. At the end of 1915 the plaintiffs said in terms, "We

will not pay you for goods of enemy origin." The position then was this: having a contract under which by its terms the defendants were entitled to supply German goods, and being a neutral country they were, of course, at liberty to get German goods, the plaintiffs said, "If you supply goods which under the contract you are entitled to supply and we are bound to accept, we shall not pay for them." That was as clear a repudiation of the contract as one could have. It might be that the plaintiffs could not have paid for them without committing a breach of the law over here. He rather gathered from the plaintiffs' evidence that that answer was not open to them, because they could have got a licence if they had tried, but whether they could or could not, they told the defendants in December, "We cannot and will not perform any part of the contract if you deliver goods which under the contract we know you intend to deliver and are entitled to deliver." The defendants, further, were saying quite plainly in 1916 that inasmuch as both sides could not perform the contract according to its terms, it would have to be modified. It was clear that by the end of 1916 both parties had acquiesced in the position that although the defendants still wanted to do the work when it became possible and the plaintiffs also wanted it to be done, the terms upon which it was to be done were to be a matter of negotiation between them, and these terms had never been arranged. The contract was ended at the latest by the end of 1916.

When the hearing was resumed on July 6th, Mr. Hogg stated that since the adjournment the parties had been discussing the matter, and he thought they had arrived at a settlement. His clients, however, were a Swiss company, and they had to get confirmation from Baden. They therefore wished the case to stand over until Friday, when it was hoped there would be an end of the case.

His Lordship agreed.

Hastings Corporation and the Tramways Co.
The Arbitrator's Award.

Mr. William Weeks Szlumper, barrister-at-law, and a member of the Institution of Civil Engineers, as arbitrator, has issued his award in the case of the Hastings Corporation and the Hastings Tramways Co. It concerned a point of controversy in the matter of the relighting on the line of tramways on the Front, which the Tramways Co. has to undertake under its Act of last year. The arbitration recently took place at the Surveyors' Institution, Westminster, as reported in our columns.

The Arbitrator states his award in the form of a special case, and explains that he has done so at the request of the Tramways Co. He proceeds to state that the facts were proved before him as follows: The current required for the lamps upon the existing electric standards of the Corporation along the route of Tramway No. 1 referred to in Sub-section 3 of Section 6 of the Hastings Tramways Act, 1920, was conveyed by means of a cable belonging to the Corporation laid in the roadway. The substituted electric lamps necessitated either a new cable or an addition to the existing one. It was contended on the part of the Corporation that the proper legal construction of the said Sub-section 3 provided that the company should at its own expense either lay a new cable or by addition to the existing one render it capable of satisfactorily conveying current to the substituted electric lamps. It was contended on the part of the company that the word "cable" in Sub-section 3 referred only to a part of the connection between the substituted electric lamps and the said cable of the Corporation, and that the provisions of Sub-section 3 did not place upon the company the obligation to lay any cable other than that necessary for connection between the substituted electric lamps and the cable conveying current along the route of Tramway No. 1. The Arbitrator states his decision in the following terms: "I award and determine, subject to the opinion of the Court, that having regard to the fact that either a new cable laid along the route of Tramway No. 1 or a sufficient addition to the existing cable is necessary in connection with the substituted lighting, the provisions of Sub-section 3 of Section 6 of the Hastings Tramways Act, 1920, place upon the company an obligation at their own expense to provide and lay such a cable or such an addition to the existing cable, and I direct (subject to my directions hereinafter made) that the company do pay to the Corporation its cost of the reference to be taxed, and that the company do pay costs of this my award which I have taxed or settled at the sum of £44 15s. 6d."

Preston Electricity Undertaking.

According to the *Manchester Guardian* on July 3rd, the National Electric Supply Co., Ltd., of Preston, applied to Vice-Chancellor R. B. Lawrence, K.C., at the Chancery Court in Manchester, for sanction to be given to a scheme of arrangement with regard to the basis upon which the distribution of the profits and of the assets in a winding-up should proceed as between the various classes of shareholders.

Mr. F. J. Kerr (who appeared for the applicants) said the company was incorporated in 1889 with the object of carrying on the business of electric lighting and of producing and supplying electricity. The issued capital was now 16,545 preference shares of £5 each, 10,850 ordinary shares of £3 12s. 6d. each, and 100 founders' shares of £3 12s. 6d. each, all fully paid. For the year ending December 31st, 1920, the gross profit was £20,052, and the assets shown by the balance sheet amounted to £288,572, against which were liabilities to trade creditors (£41,497) and sums borrowed from time to time on loan (£39,738). By a provisional agreement dated March 30th, 1921, the Preston Corporation agreed to buy the undertaking upon terms which, Mr. Kerr said, would work out at a total of £266,000; £61,000 would be paid by the Corporation in cash and the remaining £205,000 would be satisfied by the issue of mortgages secured on the borough rates. At present the agreement was only conditional. Doubts had arisen as to the rights of the various classes of shareholders with regard to the return of capital and participation in surplus assets in the event of a winding up, but a scheme had been approved at the meetings of the shareholders, and his Honour was now asked to give his sanction.

It was stated that a provision for payment of a fixed sum as compensation to the directors had been disclosed to the shareholders. The Vice-Chancellor said the payment was quite regular, but the Registrar must be satisfied that it had been disclosed to the shareholders. Subject to the filing of an affidavit on that point he sanctioned the scheme.

The Bastian Electric Co., Ltd.
Petition Dismissed.

The petition of W. F. N. May and Another for an order for the compulsory liquidation of the above company was disposed of by Mr. Justice P. O. Lawrence in the Companies' Winding-up Court on Tuesday.

Mr. Dighton Pollock, for the petitioners, said that last week they were paid £25, and they had now been paid out, and he asked for the petition to be dismissed.

Counsel for the company said it had been agreed that there would be no infringement of their patents, and that the petitioners would hand over certain management shares.

His Lordship dismissed the petition upon payment of the petitioners' costs.

Marconi's Wireless Telegraph Co., Ltd., *v.* A. W. Gamage, Ltd.

Mr. Justice Eve, in the Chancery Division on July 12th, heard a motion for judgment in this case.

Mr. J. Whitehead, who moved on behalf of the plaintiff company, said that this was a patent action, and the infringement alleged was in respect of the sale and offer for sale of a certain wireless receiving set known as the "Polaris Receiving Set."

The motion was by consent, Mr. Eric Bousfield appearing for the defendants.

The terms provided for an injunction restraining infringement as set out in the settlement of claim, £150 agreed damages, and the destruction of infringing apparatus by dismantling and breaking up into their constituent parts.

Calumet Power Station of the Commonwealth Edison Co.—The new power station at Calumet, which is designed to contain generators of 180,000 kW, will include the latest devices for economising energy. The boilers are of the Babcock & Wilcox type, built for a pressure of 350 lb. per sq. in., and a superheat of 250 deg. Fah., the temperature of the steam being 685 deg. Fah. Each boiler will be capable of evaporating 150,000 lb. of water per hour. Chain-grate stokers and forced draught will be used. The boiler tubes are 20 ft. long and four inches in diameter, and the total heating surface is 15,089 sq. ft., the superheating surface adding 4,000 sq. ft. The grate surface is 376 sq. ft., and the volume of the furnace 6,700 cu. ft., the head-room beneath the tubes being 20 ft. Induced-draught fans will be provided, and the steel chimneys will have a height of 167 ft. The economisers will have steel tubes and steel headers, of a total heating surface of 9,600 sq. ft. per boiler. The boiler efficiency is expected to be 74 or 75 per cent., to which the economiser will add 7 or 8 per cent. The temperature of the feedwater will be raised to 175 deg. Fah. before entering the economiser, to prevent condensation, with steam derived from the later stages of the turbines. Air heaters may be provided, reducing the temperature of the flue gases from 350 to 250 deg. and heating the air to 200 deg. Fah., but the probability of serious corrosion through condensation renders the use of air heaters doubtful, the coal containing nearly 5 per cent. of sulphur. Two generating sets are being installed, one having a General Electric 7-stage impulse turbine with maximum economy at ¾ load, and the other having a Westinghouse tandem compound turbine. Eventually the station will contain six sets of 30,000 kW at 85 per cent. power factor, 12,000 volts, 1,200 r.p.m. The condensers will have a surface of 52,000 sq. ft., and provision will be made for cleaning them whilst in operation. There will be four boilers to each generating set, and the boiler-room occupies two-thirds of the total building area. Fuel costs will be about 86 per cent. of the total operating costs. It is expected that the kWh will be generated with an expenditure of 19,000 B.th.u.

BUSINESS NOTES.

Bankruptcy Proceedings.—*Re* Charles Augustus Carpenter, electrical engineer, Mason's Avenue, Basinghall Street, E.C.—Creditors under this failure met on July 11th, before Mr. W. P. Bowyer, senior Official Receiver at the London Bankruptcy Court. The chairman reported that the debtor had stated that he commenced business in June, 1917, with stock £100 and cash £50. Previous to that he was partner with Mr. W. R. Fardon, a contracting electrician, and their business was converted into Fardon and Carpenter, Ltd., which went into voluntary liquidation in 1914, the debtor being appointed receiver for the debenture-holder. He next started to make electrical apparatus, and in 1916 he was joined in partnership with Mr. O. Brink, but that partnership was dissolved shortly afterwards, Mr. Brink remaining in possession of the business in consideration of the £200 capital which he had introduced. The debtor next became managing director of C. A. Carpenter, Ltd., which was formed to exploit a patent burglar and fire alarm of his own invention. Twelve months later he resigned that office, and started business on his own account as C. A. Carpenter; the company of that name having changed to Alexander Bruce, Ltd. Early in 1919 the debtor was joined by two partners, and in March, 1921, the assets of that business were sold to C. A. Carpenter, Ltd., a private company, the debtor receiving 800 fully-paid £1 shares, and being appointed managing director, which position he still held. No accounts had been lodged; the debtor estimated his liabilities at £1,200; he had no assets, and he attributed his failure to losses in trading, difficulties with labour, lack of capital, two serious illnesses, the trade slump since December last, and the withdrawal of banking facilities. In the absence of any offer, the case was left to the Official Receiver to be wound up in bankruptcy.

Re John Henry Toms, electrical engineer, 16, Cecil Road, Muswell Hill, trading at 13, Gray's Inn Road, W.C., under the style of J. H. Toms & Co.—The first meeting of creditors in this case was held on July 11th before Mr. Walter Boyle, Official Receiver, at the London Bankruptcy Court, when accounts were presented, showing total liabilities £1,985 (unsecured £1,693), and net assets valued at £193. The chairman reported that it appeared from the debtor's statements that in June, 1918, he commenced business as above, but he had no partner; his capital of £75 was raised on a bill of sale for £100 over his household furniture, but that amount proved insufficient, and he had recourse to professional money-lenders. During the first 12 months, the trading did fairly well, and he reduced the amount on the bill of sale, but after the Armistice it dropped away, and requiring further capital, he renewed the bill of sale twice, eventually paying it off out of a loan of £500, the balance of the loan being used in discharging personal debts. The business was brought to a standstill by the action of creditors, who levied execution at the Gray's Inn Road premises. The failure was attributed to want of capital and heavy interest charges. Mr. H. J. de Coursey Moore, chartered accountant, 2, Gresham Buildings, E.C., was elected trustee to wind up the estate in bankruptcy.

K. H. Kerr & Co., electrical accessories manufacturers, Barr Hill Works, Dalbeattie.—At the meeting of creditors on July 5th, Mr. W. B. Galbraith gave an account of his investigations. A trading and profit and loss account from June 1st, 1919, to June 30th, 1921, was submitted, the loss on trading during the period being £810. The liabilities were £1,876, and the net assets £1,066. After discussion, the meeting resolved, with two dissentients, to recommend the acceptance of a cash composition of 10s. in the £, and the debtors were allowed 10 days in which to obtain the necessary financial assistance to pay the composition. A committee was appointed to advise with Mr. Galbraith.

Wollman, H. M., electrical factor, lately carrying on business at 9, Greasbro' Road, Parkgate, near Rotherham.—Petition granted at Sheffield, on debtor's own petition, on July 5th. First meeting, July 19th; public examination, August 4th; both at Sheffield.

Dale, B. T., electrical engineer, trading at Erick Street, Newcastle-on-Tyne.—Trustee, Mr. Brittain, 15, Pilgrim Street, Newcastle-on-Tyne.

Hepher, J. (trading as the Croft Electric Cabinet and Joinery Works), Spital Tongues, Newcastle-on-Tyne.—Trustee, J. A. Gardner, 24, Grey Street, Newcastle-on-Tyne.

Sutcliffe, G., Abertillery, electrical engineer.—Order made on May 25th, suspending discharge for two years.

Catalogues and Lists.—British Insulated and Helsby Cables, Ltd., Prescot, Lancs.—Publication P 167. An illustrated catalogue of paper-insulated cables of many types—single, twin, concentric, &c—and of all sizes. Each type is illustrated, and full details of conductors, dielectrics, &c., are given.

Messrs. Cookson & Co., 25, New Oxford Street, W.C.—A leaflet giving prices, particulars, and illustrations of various accumulator accessories, such as hydrometers, india-rubber corks, voltmeters, &c.

The Whitworth Electric Lamp Co., Ltd., 195, North End Road, West Kensington, W. 14.—A priced, illustrated leaflet showing various types of opal glass bowl fittings.

The Vaughan Crane Co., Ltd., Openshaw, Manchester.—A booklet (No. 8) of reproduced photographs of a number of electric crane and hoist installations and views of the company's works.

Messrs. Clayton & Shuttleworth, Ltd., Stamp End Works, Lincoln.—Publication No. 320. A well-illustrated descriptive catalogue of "Clayton" valveless crude oil engines of various sizes, many suitable for driving generators for farm work.

Messrs. Salterns, Ltd., Salterns Works, Parkstone.—A catalogue dealing with the development of water power, illustrating and describing several types of turbines and Pelton wheels.

Mr. H. C. Slingsby, 142-146, Old Street, E.C. 1.—Publication No. 170, giving numerous illustrations and specifications of electric industrial trucks, tractors, &c.

Z Electric Lamp and Supplies Co., Ltd., 73, Newman Street, W. 1.—A priced and illustrated booklet, advertising the "Electrolux" electric suction cleaner.

W. R. Patents, Ltd., 8, Old Jewry, E.C. 2.—A folding card, illustrating the "W.R." CO_2 indicator with application card for booklet.

Igranic Electric Co., Ltd., 147, Queen Victoria Street, E.C. 4.—An illustrated folder, dealing with various descriptions of coils for electrical purposes, embodying an order postcard.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C. 2.—Leaflet O.S. 2,538. An illustrated and priced pamphlet, advertising a case for spare automobile lamps.

Messrs. Meldrums, Ltd., Timperley, near Manchester.—A priced and illustrated pamphlet, giving full particulars of the construction and use of the "Sack" portable steam-disinfector.

Messrs. F. J. Shenton & Co., Ltd., 68 and 69, Shoe Lane, E.C. 4.—A price-list of silk-covered copper wire.

Messrs. Archibald J. Wright, Ltd., 395, City Road, E.C. 1.—Two illustrated price-lists of electrical goods, including small instruments, accumulators, pocket lamps, magnetos, &c.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C. 2.—Pamphlet S 2,352. An illustrated and priced publication dealing with "Fairyland" strip, which consists of lighting cable in which lampholders are fitted at equal distances. It is intended for decorative illumination.

Messrs. Rayner & Heald, Ltd., Duke Street, Derby.—A stock-list giving details of squirrel-cage and slip-ring motors of various powers.

"Attracta" Electrical Co., 11, Hanway Place, Oxford Street, W. 1.—An illustrated leaflet giving prices of "Auto" electric flashers for signs, &c.

Messrs. Scholey & Co., Ltd., 56, Victoria Street, Westminster, S.W. 1.—A priced pamphlet illustrating and describing the "Croydon" electric suction and blowing cleaner. Also Pamphlet M 2, giving an illustrated description of fractional h.p. motors ranging from $\frac{1}{15}$ to $\frac{1}{2}$ h.p. Priced.

Dissolutions of Partnership.—Cayless & Potter, electrical and general engineers, Gladstone Mews, Wood Green, Middlesex.—Messrs. H. G. Cayless & P. F. G. Potter have dissolved partnership. Mr. Cayless attends to debts, &c., and continues the business under the old title.

Messrs. John Palmer Castle and Cyril John Arnold, trading under the style of "The Electrical Equipment and Installation Co.," at 64, Finsbury Pavement, E.C., have dissolved partnership. All debts will be attended to by their solicitors, Messrs. Castle & Co., 31, Gracechurch Street, E.C. 3.

Trade Announcements.—Messrs. London Factors and Agents, Ltd., inform us that Mr. F. L. Strawson has left the board of directors, and has severed his connection with the company.

The Alton Battery Co., Ltd., of Alton, Hants, has opened a branch office at 90-91, Queen Street, Cheapside, London, E.C. (Telephone No. "Central 8112"), under the management of Mr. D. Mackay Robertson, who will deal with the sales of A.B.C. accumulators in London and the Home Counties.

The British Electric Plant Co., Ltd., of 66, Carrick Street, Glasgow, has removed its London office to 11, Upper Woburn Place, W.C. 1.

The new telephone number of Messrs. A. Verey & Co. is "Victoria 3189," *not* 3180, as stated in our issue of July 1st.

The Cardiff branch office of the Edison Swan Electric Co., Ltd., has been removed to larger premises at 25-27, Charles Street. The branch is now in direct touch with the company's works, instead of being a subsidiary branch working from Bristol. Mr. W. Elliott, B.Sc., A.M.I.E.E., has been appointed superintendent of the new district.

Mr. W. Dundas Fox has opened offices and stores at 80A to 86A, Manningham Lane, Bradford, as an electrical and mechanical engineer and textile electric drive specialist.

Messrs. Forrester & Fox, Ltd., conduit fittings manufacturers, of Beehive Wharf, Brentford, have obtained the permission of the Board of Trade to change their name to that of "Pelican Electric, Ltd." Messrs. A. Fox and Mr. F. F. Whiteing are the directors. The works staff is the same, and the business is carried on at the same works.

German Iron Wire.—The Waterfalls Board has requested authorisation of the Government for the purchase in Germany of galvanised iron wire for high-power lines. The Board points out that, although the Swedish Government has emphasised the desirability of placing orders with Swedish firms, in the case in question there is financial disadvantage in purchasing the wire in Sweden, the Swedish quotation being 63 per cent. higher than the German.—*Reuter's Trade Service* (Stockholm).

Foreign Interest in Swedish Works.—A foreign firm is reported to have sought to acquire an interest in the Swedish electrical company of Luth and Rosén, but the negotiations have not led to any practical results. It is denied that Herr Hugo Stinnes was associated with the discussions.

Private Meeting.—Frederick Vigers and Charles H. Vigers, trading as Vigers Bros., Balfour House, Finsbury Pavement, London, E.C.—The adjourned meeting of the creditors was held on July 5th, at the Institute of Chartered Accountants, Moorgate Place, E.C., when Mr. Agar, who represented the Associated Importers, Ltd., was elected to the chair.

The statement of affairs, which had been prepared by Messrs. Tribe, Clarke, Painter, Darton & Co., chartered accountants, of Balfour House, Finsbury Pavement, E.C., disclosed ranking liabilities of £143,490, against net assets of £52,869, or a deficiency of £90,621.

The chairman said it would be recalled that the meeting was originally adjourned in order that a printed statement of affairs might be prepared and circulated while a committee was also appointed to consider the position. That committee had met and gone fully into the matter, and would make a report to the creditors.

Mr. Gordon Clarke (Messrs. Churchill & Sims) said he was one of the committee appointed at the last meeting. In the first place, the committee satisfied themselves that the partners had given all the information that it was possible for them to give, and the committee also satisfied themselves as to the assets of the partnership and the private estate. A close examination of the figures would show that the estate would not produce the 7s. 6d. in the £ which was suggested as the composition to be paid at the last meeting of the creditors. It appeared to the committee that the utmost which could be paid was 6s. in the £. His own opinion was that a dividend of that amount should be accepted. He read the full recommendation of the committee.

Mr. A. G. Westacott (Messrs. A. G. Westacott & Co.) said that he understood the scheme to be that there would be a deed of inspectorship, and the creditors would accept a composition of 6s. in the £. The creditors would accept that 6s. in full discharge if nothing unforeseen happened. The statement showed about 7s. in the £, but the creditors would accept 6s., and they were also given an opportunity of getting a further 9s. in the £. If liquidation took place after the 6s. in the £ had been accepted, the creditors would take 25 per cent. of the assets. He proposed a resolution in favour of the acceptance of the scheme outlined by the committee.

Mr. W. Crow seconded the motion.

The resolution was carried by a large majority, only the representative of one firm voting against it.

Three of the principal creditors were appointed to act as inspectors.

E.D.A. Activities.—The latest publication of the British Electrical Development Association (E.D.A. 175) is an endeavour to explain to the uninitiated consumer of electricity the necessity of a fixed minimum charge. It shows that even if the quantity covered by the charge is not used, the station plant and staff must always be ready to answer the call of the consumer. Moreover, it points out that the cost to the consumer of this tireless service is really small when spread over the year; indeed, in the average example quoted, it amounts to no more than 1½d. a day even if no energy is used at all. It further explains that if the minimum is exceeded there is virtually no direct charge at all for the station's "readiness to serve."

Stoker Contracts.—Recent sales effected by the Underfeed Stoker Co., Ltd., include the following for electrical stations:—

Wolverhampton, eight travelling grates; St. Helens, four travelling grates; Sheffield, two travelling grates; Newcastle Electric Supply, one travelling grate and air heater; Rotterdam, four travelling grates; Cossipore, India, four travelling grates; Poplar, Bury, and Bradford, ash conveyors.

Oil Fuel.—Messrs. Meldrums, Ltd., of Timperley, have recently received orders for oil fuel burners for the Bangor and Altrincham electricity departments.

The Electric Lamp Manufacturers' Association.—Mr. J. E. Edgecombe, the director, notifies us that the address of the Electric Lamp Manufacturers' Association of Great Britain, Ltd., is now Elma House, 25, Bedford Square, London, W.C. 1. Telephone numbers: "Museum 7828 and 7829"; telegraphic address: "Britelma, Westcent, London."

Trade Conditions in Australasia.—On June 30th ended one of the most trying periods for many years. The policy of deflation has resulted in a good deal of writing-down lately, much of which has been substantial. Owing to the prosperity inland and in town and country, buying stocks in the warehouses have been largely reduced, which, combined with the skilful handling of the situation by the banks, has resulted in only a low percentage of compositions. The favourable seasonal outlook is imbuing business men with a more hopeful feeling. In the opinion of an authority at Sydney, the outlook is uncertain, with a tendency towards an immediate mild revival of trade, attended by a partial rise in prices. Prices in New Zealand are generally firmer, warranting the opinion that a steady revival has set in, but the curtailment of indents, following unprecedented imports, has resulted in an almost acute shortage in some lines of necessities.—*Reuter's Trade Service* (Melbourne).

Withdrawal from Industrial Council.—By a large majority the Aberdeen Town Council, on July 4th, decided to withdraw from the Scottish District Industrial Council. The decision was made principally on account of the Corporation's disagreement with a re-arrangement of working hours and conditions of service made by the Industrial Council.

British Goods in Italy.—The Advisory Commission for Importation, representing the Ministry of Finance, has received a telegram from the Federation of British Industries' Commissioner in Italy, asking for a commercial amnesty for British goods stopped by the Italian Customs owing to the absence of import permits. The Commissioner observes that the goods are being ruined, while the Customs might secure considerable sums in the shape of import duties, and at the same time help the good relations between the two countries.—*Reuter's Trade Service* (Milan).

Australian Anti-Dumping Measures.—Mr. Massy Greene, Minister of State for Trade and Customs, introduced a Bill in the House of Representatives, on July 7th, to constitute a Tariff Board, composed of three members, to which the Minister could refer matters relating to the classification and value of dutiable goods, the necessity of Tariff and Excise increases and reductions and the granting of bounties. The Minister added that Parliament would retain the right of final decision in all matters. Mr. Massy Greene also explained a resolution to prevent dumping by countries whose currency had depreciated. The resolution included the imposition of special anti-dumping duties in addition to the ordinary Customs duties.—*Reuter's Trade Service* (Melbourne).

Electric Iron and Steel Furnaces in Brazil.—The Commercial Secretary to His Majesty's Embassy at Rio de Janeiro (Mr. Ernest Hambloch), has forwarded to the Department of Overseas Trade some notes on the Brazilian President's message to Congress at the opening of the first session of the new legislature. The President dealt at some length with the subject of the utilisation of Brazil's immense resources of coal and iron, and said that with a view to establishing not only the possibility of the manufacture of metallurgical coke from Brazilian coal, but also the cost of production of pig iron and steel in electric furnaces either with national coke or with charcoal, the Government sent to Belgium several tons of coal from the mines in Santa Catharina and Rio Grande do Sul, and appointed a professor of the Ouro Preto School of Mines to accompany and control the tests in first-class establishments. In the Coppée works of Belgium, metallurgical coke has been manufactured from Brazilian coal, with highly satisfactory results.

The experimental manufacture of pig iron and steel from Brazilian ore and Brazilian metallurgical coke or charcoal is to be carried out in electric furnaces in Sweden, to which country the necessary coal has also been sent. Simultaneously the Government is taking stock of the hydro-electric resources of Brazil.

The Esperanca (Usina Esperanca), in Minas Geraes is the only source of supply for national foundries and mechanical works. Its production of pig iron is approximately 15,000 metric tons per annum. The company hopes to erect within a short time small works for the manufacture of steel in an electric furnace.

One electric furnace is at present in existence in Sao Paulo with a capacity of 1,000 kg. for the manufacture of steel from pig iron, and besides this there is another small electric furnace for the melting of pig iron.

It is stated that the Companhia Electro-Metallurgica Brasileira will, by the end of the year, have in operation at Ribeirao Preto a factory for rolled steel, and be able to produce everything from pig iron in electric furnaces with charcoal to the most complex siderurgical operations.

The Anglo-Brazilian Iron and Steel Syndicate also intends to erect not far from the city of Rio de Janeiro iron and steel works which will employ electro-metallurgical methods.

Trade Conditions in Australia.—In its report for the year ended April, 1921, the Electrical Traders' and Contractors' Association of Victoria, says that while the conditions under which business has been conducted during the year have materially changed from those which existed at the time of the last report, it cannot be said that the hope then expressed, that affairs would soon have straightened themselves, has yet been realised. The transition period is not yet at an end, and industrial affairs still figure prominently in all commercial arrangements. "In addition, a world-wide trade depression, being the unavoidable reaction following upon the abnormal conditions of the war period, has taken place within the last few months, and all business men are faced with the problems arising out of the contraction of trade and falling markets."

Industrial affairs have occupied a good deal of attention. Last year the Association announced that licensing of wiremen was an accomplished fact. The Association was exceedingly sorry that it had been unable to secure the much needed licensing of employers, but it was hoped that before long this would be accomplished.

With regard to co-operation for improvement in the electrical industry, early in the year the question of the reorganisation of the Association, in order that this question might be completely dealt with in all its aspects, was referred to the members of the Inter-Trade Relationships Committee, who have spent a large amount of time and trouble in connection therewith, and a good deal of information regarding similar Associations in Great Britain and America has been obtained. As, however, the time which the members of this Committee had to spare to give to this important work was limited, it was decided to call in the assistance of an experienced trade organiser, and it was hoped that something in the nature of a definite recommendation would be available at the annual meeting of the Association to be held in June.

Argentina and Trusts.—The Chamber has passed a Bill for the repression of trusts.—*Reuter's Trade Service* (Buenos Aires).

Heating and Cooking Apparatus: Prices Reduced.—THE GENERAL ELECTRIC CO., LTD., has issued an announcement of a reduction of 15 per cent. in prices of "Magnet" electric heating and cooking appliances.

Commercial Monopolies in Italy.—The *Gazzetta Ufficiale* publishes a decree replacing the electric lamp monopoly by a tax on manufacture. Certain other articles are similarly dealt with.

Swiss Foreign Trade.—It is announced that the members of the Swiss Society for the Development of Foreign Trade have decided to dissolve the society. This decision has been arrived at inasmuch as the negotiations entered into between States and the various countries in Eastern Europe have shown that by a mere exchange of goods it was impossible to develop foreign commerce, owing to the existing international economic crisis and the complete transformation of the general economic situation which has taken place since the establishment of the society. The assembly which adopted the above decision, expressed a desire that the States' authorities should assume in future the task undertaken by the society, which included, besides the exchange of goods, services of information, commercial aid, organisation and transit of goods trains, and the utilisation of Swiss capital in foreign countries.—*Reuter's Trade Service* (Berne).

Outings.—A very successful picnic, arranged by the Liverpool Social Committee of the local factors and members of the N.F.E.A., took place on Saturday, July 2nd. A party of nearly 100 persons went for a charabanc drive to Llangollen. Luncheon and tea were partaken of at the "Woodlands," a large private residence taken over by the garage proprietors for catering purposes. In the interval between luncheon and tea impromptu sports were held on the recreation field attached to the house, and after tea Mrs. Crawford, wife of Mr. F. Crawford, of the General Electric Co., distributed the prizes. Mr. Crawford moved a vote of thanks to the Social Committee. Mr. Percy Davies (Messrs. Downes & Davies) seconded, and Mr. Tom Woods replied for the Committee. The hope was expressed that the outing would be an annual affair, as it was the means of bringing factors and contractors into closer contact with each other. The party drove back from Llangollen to Birkenhead in the evening.

An outing of the London staff of Messrs. Falk, Stadelmann and Co., Ltd., took place on Monday, July 4th. The party, numbering 630, travelled by motor-charabancs to Southend-on-Sea, where luncheon was served at the Palace Hotel. Following the loyal toast, Mr. Stockwell, the senior representative of the firm, proposed the toast of "The Firm," which was replied to by the chairman, Mr. Max Falk.

On Saturday last the employés of Messrs. S. Charlesworth and Co., electrical engineers, Oldham, held their second annual picnic, journeying by charabanc to Neston *via* Liverpool and Birkenhead. At Liverpool the party made a halt, and were shown over the showrooms of Messrs. Downes & Davies. Mr. Batty, their Manchester representative, introduced the party, and conducted them over the premises. At Neston, dinner was partaken of, followed by a game of bowls. During the afternoon the party went for a run to Hoylake, and after tea returned, travelling *via* Chester.

British Trade-Mark Applications. — Appended is a summary of the recent applications for British trade-marks in respect of goods and productions connected with the electrical trades and industries :—

I.D. (lettering combined with design) No. 409,235. Class 5. Electric wire. No. 409,236. Class 6. Electrical machinery and parts. No. 409,237. Class 7. Electrical instruments. No. 409,238. Class 13. Electrical fittings of metal. No. 409,239. Class 16. Electrical fittings of porcelain or earthenware. No. 409,240. Class 18. Electrical installations. Ernestine J. G. Pacault, 18, Rue Van den Corput, Forest, Brussels, Belgium. October 29th, 1920.

Mercury. No. 407,984. Class 13. Sparking plugs. Wm. H. Gold and Walter Gold, trading in co-partnership, 309, Summer Lane, Birmingham, September 18th, 1920.

Gripaco motor lock for cars and cycles. "A Policeman on your Motor" (lettering combined with design). No. 408,153. Class 13. Electric switch for use in connection with the starting gear of motor vehicles, so as to prevent theft. Motor Inventions, Ltd., 30-32, Ludgate Hill, London, E.C. September 24th, 1920.

Insuflexa. No. 414,424. Class 50. Electrical insulating preparations and materials. Robt. Ingham Clark & Co., Ltd., 24, Grosvenor Gardens, London, S.W. April 19th, 1921.

Celestron. No. 414,855. Class 50. Electric insulators and electric insulating materials. Siluminite Insulator Co., Ltd., The Green, Southall, Middlesex. May 3rd, 1921.

N.E. (lettering and design). No. 414,331. Class 6. Electric motors and generators. North-East Electric Co., 348, Whitney Street, Rochester, N.Y., U.S.A. April 14th, 1921.

Wizza. No. 413,194. Class 13. An electric spark increaser for use in the ignition circuit of internal combustion engines. Kardoo and Elliott, 27, Russell Street, Brixton, S.W. March 8th, 1921.

For Sale.—Among the plant to be sold by auction at Bekesbourne Aerodrome, near Canterbury, on July 29th, by order of the Disposal Board, are :—Two 20-h.p. "Aster" petrol engines, two 11-kW E.C.C dynamos, an electrically-driven centrifugal pump, cable, insulators, &c.

Among the material to be sold by auction at Eastleigh Aerodrome, on July 28th and 29th, by order of the Disposal Board, are a 3-ton electric winch, electric motors from ½ to 20 h.p., portable electric tools, and a quantity of other electrical material, including motor starters, blowers, &c. For further particulars see our advertisement pages.

British Manufacturers and New Zealand. — The *Auckland Weekly News* says that Mr. A. Wyllie, the Auckland electrical engineer, referring to the arrangements made with regard to the purchase of the necessary equipment and machinery for the extension of the city electrical plant, said that when he left for Britain he was afraid he would not be able to carry out the scheme within the estimates that had been made. On his arrival he found that manufacturers were beginning to look for orders after a period of exceptional activity, and prices were beginning to fall. He, therefore, left the date for the return of tenders as late as possible, with the result that excellent competition was obtained and good contracts were made. In view of this the scheme should be completed within the cost originally estimated. Mr. Wyllie added that the fact that he was able to notify tenderers that the Council would provide cash against documents was a strong factor in attracting competition among the manufacturers.

Foreign Trade.—JUNE FIGURES.—The following are the values of imports and exports of electrical goods and machinery in June :—

	June, 1921.	*Inc. or dec.*	6 months, 1921. *Inc. or dec.*
IMPORTS.	£	£	£
Electrical goods, &c.	191,459	+ 67,087	+ 644,302
Machinery	783,364	− 934,533	− 2,217,577
Electrical machinery (included above)	51,463	− 43,605	− 215,102
EXPORTS.			
Electrical goods, &c.	877,190	− 335,170	+ 2,425,165
Machinery	5,285,130	+ 258,847	+17,297,462
Electrical machinery (included above)	330,787	+ 157,173	+ 1,508,814
RE-EXPORTS.			
Electrical goods, &c.	14,085	+ 3,816	+ 79,321
Machinery	102,092	− 57,828	− 157,349
Electrical machinery (included above)	712	− 1,531	+ 5,027

Ecuador.—A DWINDLING MARKET.—Machinery and apparatus was imported into Ecuador to the value of £220,000 in 1919 (the latest year for which statistics are available), as compared with £106,000 in 1918, and only £97,000 in 1917. It is not recorded exactly what share the United Kingdom took in this trade, but it is known that her share in Ecuador's total trade dwindled from 25 per cent. in 1917 to nearly as low as 12½ per cent. in 1919. The Consul-General at Quito says in his recent report that although the bulk of the trade of Ecuador has been carried on with the United States of America, local importers are now inclining towards the establishment of commercial relations with British firms to the exclusion of their American competitors. The following are some of the reasons to which this change of attitude may be ascribed :—

1. The high rate of New York exchange comparing unfavourably with that ruling for the £ sterling.
2. The long recognised superiority of British goods.
3. Increasing tendency on the part of Ecuadoreans to avoid dependence in any form—commercial, financial, or political—on the United States.

If British manufacturers are prepared to offer facilities, and at least, meet Ecuadorean merchants half way, there is every probability of a substantial increase of British imports.

At present, however, depression prevails owing to excess importation of manufactures and the poor demand for cocoa, which is Ecuador's staple export.

Waterways and Power Stations.—A joint conference of the Central Association for German Inland Navigation, the Main-Danube River Union, and the German-Austrian-Hungarian-Swiss Union for Inland Navigation has just been held at Munich in connection with the Waterways Exhibition in that city. The Prime Minister of Bavaria stated that the question before them was to endeavour to realise the long-discussed object of establishing a permanent connection between the Rhine and the Danube, the North Sea and the Black Sea by means of an adequate navigable network for ships up to 1,500 tons. The scheme included the erection of 45 power stations, having an annual production of 2,000,000,000 kWh, which were to be incorporated in the great ring of the Bavarian electricity works, and be of advantage also to Baden, Hesse, Wurtemberg, and the districts in Central Germany. It was expected that the revenue from the sale of power would suffice for the financing of the entire great navigable route. The General Minister of Communications said that Bavaria entertained the idea that the scheme should be carried out on a joint economic basis, and he suggested that a limited company should be formed for the realisation of the project.

High-Pressure Transmission in France.—The French Compagnie Electro-Mécanique is reported to have received an order for transformers and accessory apparatus in connection with the electrification of a portion of the system of the Southern Railway Co. The transmission is to be at 150,000 volts, which is said to be the first at this pressure in Europe. The Compagnie Electro-Mécanique is a licensee of the Swiss Brown-Boveri Co., and from the fact of its recent absorption of the French Westinghouse Co. is assured of the support of the American Westinghouse Co., as well as, it is stated, of the Metropolitan-Vickers Electrical Co.

Abolition of Polish Commercial Restrictions.—The *Journée Industrielle* learns from Warsaw that the Council of Ministers has decided to render trade in products free, as from September 1st next.—*Reuter's Trade Service* (Paris).

Book Notices.—"The Engineering Index, 1920" (586 pp.). New York: The American Society of Mechanical Engineers. Price $6.—This is the 19th appearance of an index which is compiled from the leading technical journals and the "proceedings" of technical societies in all parts of the world. It is impossible to indicate properly its very wide scope, but the method of arrangement enables the reader to find information on practically every branch of science and engineering. The brief *résumés* are adequate guides to the suitability of the articles indexed.

"Kelly's Directory of Merchants, Manufacturers, and Shippers of the World." Thirty-fifth annual edition. Two volumes. 64s. net. London: Kelly's Directories, Ltd., 186, Strand, W.C. 2.—While it is true that these volumes appear, as the preface says, during a period of international unsettlement, it is equally true that they appear at a time when a host of British trade-seekers are eagerly intent on foreign trade expansion. This means that they are on the look-out for helps to information which will enable them to approach, with a certain measure of confidence that their time and money will not be wasted, possible buyers in the various overseas markets. New markets have to be found, and old connections remade, if we are to find an outlet for the very large production of which the industrial millions of these islands are capable. Whether we have representatives abroad or not, we all need volumes which contain directory information which can only be gathered together efficiently as the result of an experienced and well-organised central effort such as has been put forth by the compilers of the two bulky volumes that are now before us. When it is stated that this edition involved over 600,000 alterations in trade references alone, some idea may be gathered of the magnitude of the work. The books are largely used in other countries of the world, and, in view of the importance of foreign-trade activity on our part at this vital stage in our history, a strong effort is this year being made to extend their use at home. We hope it will succeed. It certainly should, for, to many traders, the volumes are well worth the cost.

Miscellaneous Publication No. 46 of the U.S. Bureau of Standards, "War Work of the Bureau of Standards" (229 pp.). Washington: Government Printing Office. Price 70 cents.—In this volume is briefly outlined the work carried out by the Bureau in a number of directions—chiefly for the military departments. Aeronautics occupies a large part of the publication, but practically every other science has its place. Tests were carried out on a wide range of subjects, from ink to ordnance.

Technologic Paper No. 186 of the U.S. Bureau of Standards, "Oscillograph Measurements of the Instantaneous Values of the Current and Voltage in the Battery Circuit of Automobiles." (23 pp.) Washington: Government Printing Office. Price 10 cents.—This is an account of investigations into the demands upon starting and lighting batteries in various types of automobiles.

"The Metropolitan-Vickers Gazette," Vol. VI, No. 99, June, 1921, contains illustrated articles on the visit of the Crown Prince of Japan to the Trafford Park Works, "Breaking Capacity of Oil Switches and Circuit Breakers," by W. A. Coates, M.I.E.E., "Salford Electricity Works Extensions," &c.

"Engineering Steels." By L. Aitchison. Pp. xxxii + 396; 119 figs. London: MacDonald & Evans. Price 25s. net.

"*Proceedings* of the Physical Society of London." Vol. XXXIII, Part 4. June 15th, 1921. London: Fleetway Press, Ltd. Price 6s. net.

"Power-House Design." By Sir John F. C. Snell. Second Edition. Pp. viii + 536, 20 plates, 201 figs. London: Longmans, Green & Co. Price 42s. net.

Australia.—The Australian Customs authorities have recently made some amendments in the Customs tariff, among which may be mentioned the following:—No. 180 (1) (D), filament lamps for lighting and heating, British goods, 1s. per lb.; foreign 3s. per lb.; No. 181 (A) arc lamps, n.e.i.; covered cable and wire, n.e.i., British goods free; foreign, 15 per cent.; No. 181 (B), cables and wires, cotton covered, British, 25 per cent.; foreign, 40 per cent.

The Continental Lamp Trade.—Negotiations are reported to have been resumed by the Osram Co., of Berlin, with the Philips Lamp Co., of Holland, with a view to reaching an understanding.

Change of Address.—On July 9th the offices of our contemporary *The Electric Railway and Tramway Journal* were moved to 37 and 38, Strand, W.C. 2.

Short Time in Switzerland.—Swiss newspapers announce that Brown, Boveri & Cie., of Baden, are reducing the number of their clerical staff by 10 per cent. and the technical staff by 15 per cent. At the same time reductions in wages are taking place in accordance with an agreement between the engineering manufacturers and the Metal-Workers' Union.

A Profit-Sharing Scheme at Work.—The daily Press reports that under the profit-sharing scheme of Sir WILLIAM GRAY & Co., shipbuilders, West Hartlepool, the profit divisible for last year is £31,784, in which over 4,000 workmen participate. This is an average of nearly £8 per man.

Electric Steel Furnace for Spain.—La Sociedad Espanola de Construcciones Navales, of Bilbao, has lately placed a contract with the Electric Furnace Construction Co., of Philadelphia, U.S.A., for the supply of an electric steel re-heating furnace capable of dealing with 60 tons per 24 hours.

Lead.—MESSRS. JAMES FORSTER & Co., reporting under date July 9th, state:—"A considerable quantity of lead is arriving in the next few days, including several hundred tons of Broken Hill lead, 'Sulphide' brand, from Australia, 500 tons 'Perth Amboy' from America, and a large quantity from Spain, all of which is earmarked for consumption. The Australian lead is the first of any consequence since the strike, and it is singular that this shipment must have crossed lead on the way from London to Australia, as at least 1,000 tons were shipped in the spring.

"There has been quite a steady demand from consumers for delivery this month and during August. There is, however, very little surplus lead about, and a premium of 10s. per ton has been freely paid to obtain prompt delivery, but it is expected that the arrivals in the near future will ease the position.

"With labour conditions looking more settled than for a long time past, and a steady demand from the trade in prospect, the outlook points to less fluctuating markets at roundabout present prices."

Application for Patent Restoration.—An application has been made for the restoration of Patent No. 11,116, of 1914, "Improvements in or relating to electrical reactance coils," and Patent of Addition 3,433, of 1915, both of which lapsed on May 5th, 1918, owing to the non-payment of the prescribed renewal fee.

The Half-Year's New Companies.—In their list of company registrations at Somerset House, between January 1st and June 30th, 1921, MESSRS. JORDAN & SONS, LTD., include the following figures:—

Classes.	Totals. Number registered.	Capital.
Electric and gas...	59	£481,600
Engineers	191	1,310,990
Food	233	4,765,095
Glass and china	18	246,200
Iron, brass, &c.	190	2,771,500
Motors	141	1,016,384
Oil	19	5,513,500
Railways	3	621,000
Rubber	14	574,760
Telephones	2	7,000
Totals (first half of 1921)... ...	3,125	£52,247,158
Corresponding figures in 1920 ...	6,415	£448,738,315

It will be observed that there is a great decrease in the number of companies registered compared with the corresponding period of 1920, a comparison of the huge totals attained during the then boom period with the meagre totals attained during the present trade slump being indeed remarkable.

A German-English-American Patent Agreement.—The following apparently inspired notice appears in the German newspapers:—"Already before the war the Siemens & Halske Co. had concluded an agreement with the European companies associated with the Western Electric Co. regarding the exchange of patents, the object of which was to spare both parties costly legal proceedings, and to render possible to each the undisturbed extension of its special system. The war rendered this agreement of no effect. Now, however, the agreement—a gratifying indication of the coming together of the interested industrial circles—has been renewed for a number of years. A similar agreement also existed between Siemens & Halske and the Automatic Electric Co., of Chicago; it has now expired, and its place has been taken by an agreement with the International Automatic Telephone Co., which is connected with the Automatic Electric Co. It refers to the extension and the exchange of patents concerning the Strowger automatic telephone system."

The Engineering Trade Outlook.—Interviewed by the *Financier*, Mr. T. W. How, M.I.Mech.E., chairman of the engineering section of the London Chamber of Commerce, said:—"The general impression is that as the labour troubles adjust themselves there will be a revival in the engineering trade. It will, however, be very gradual at first, but I think it should culminate next year in something approaching a boom. The price of engineering commodities will sympathetically recede with decreased working costs.

"The question of surplus stocks, manufactured under conditions of high costs, may, perhaps, present initial difficulties in bringing down prevailing prices, but I think there will be a tendency to reduce profits and dispose of existing stocks expeditiously in order to create room for further production. Once the demand is created it is the wisest policy further to stimulate that demand by, whenever possible, a system of mass production, by which the prices of commodities can alone be lowered and thus preserve or even strengthen the wage status of the workers.

"It should not be forgotten, moreover, that in certain branches of engineering British workmanship excels, and its greater efficiency and durability will always command a higher price than that asked by foreign competitors. Taking this into consideration, I am of opinion that efforts towards lowering the cost of production must tend to place British engineering goods on an economically sound basis as regards foreign competition."

New French Companies.—La Société des Etablissements Labinal (Pièces Detachées de Mécanique et Appareils Electriques) is the name of a new company which has lately been formed in Paris (29, Rue de Londres), with a capital of 4,000,000 fr.

La Société Hydro-Electrique du Val-Vernier is the name of a new company which has lately been formed in Paris (12, Rue Castex), with a capital of 2,000,000 fr.

A German Scheme for Italy.—The management of the Italian Fiat Co., of Turin, has issued a definite denial of the report circulated that the company's works had been practically ceded to the Siemens-Schuckert Co., and that the latter had acquired 100,000 shares in the company with the object of its inclusion in the Siemens-Rhine-Elbe-Schuckert Union. What has really happened, it is explained, is that the German company last year sought to obtain possession of one of the Fiat departments for the construction of electric locomotives, and the negotiations, after interruption, were resumed recently. However, the Italian company found it impossible for the scheme to be realised at present, and on the same day as the report of the alleged cession was published at Rome, the German company caused a letter to be delivered to the Fiat company renouncing any further negotiations in the matter.

New Works in Australia.—The new works built at Waratah by John Lysaght (Australia), Ltd., for the manufacture of galvanised iron have, with their plant, cost over £250,000. They occupy 28 acres, and will produce 600 tons of galvanised iron per month. The employés number 225, and the wage bill is £1,400 per week. The company has built 64 cottages at a cost of £57,600, and the men may become owners of them on a 5½ per cent. rent purchase basis. The electrical installation at the works generates at 6,600 volts alternating, and the machinery is all driven by d.c. motors.

LIGHTING AND POWER NOTES.

Aberdeen.—Extension of Supply.—The Corporation electrical engineer has been authorised to enter into an agreement with the village of Dyce for the lighting of streets. The terms are similar to those fixed by the Corporation for the village of Stoneywood, five miles from the Corporation electricity works.

Australia. — Melbourne. — Year's Working. — The reports of the City Electric Supply Committee and electrical engineer for the year ended December 31st, 1920, have just come to hand. The accounts show a total revenue from all sources of £303,589, as against £240,081 in the previous year. The total working expenditure was £187,339, as compared with £134,854 in 1919. The gross profit was thus £116,250, as against £105,227. Capital charges and other expenses not chargeable to revenue account absorbed £77,273 (£30,492), leaving a net profit of £38,977, an increase of £8,485. After contributing to town funds, a balance of £12,254 is carried forward. The total number of units sold rose from 33,113,841 to 41,954,531, an increase of 26·7 per cent. The maximum simultaneous load was about 18,300 kW.

St. George (N.S.W.).—The St. George County Council has arranged a loan of £100,000 at 5 per cent. per annum for the purpose of carrying out an electricity supply scheme. The scheme provides for the lighting of 400 miles of streets, with over 2,000 street lights. The electricity will be supplied in bulk by the Railway Commissioners from the Illawarra power house, and the County Council will undertake the distribution to private consumers. Tenders are being invited for the work, receivable during July, and it is expected the work will be put in hand early in August.—*Reuter's Trade Service* (Melbourne).

Barrow.—Year's Working.—The recently published report of the borough electrical engineer for the year ended March 31st last, records a total revenue of £87,068, as compared with £59,147 in the previous year. Working expenses amounted to £68,663 as compared with £46,368 in 1919-20, leaving a gross working balance of £18,405, as against £12,779. Capital charges absorbed £20,944, causing a net deficit of £2,539, which, however, compares favourably with the deficit of £4,488 upon the working for the preceding year. Large increases occurred in the number of units sold, and in the maximum demand; the former rose from 6,648,423, to 9,282,017, and the latter from 3,200 kW to 4,525 kW. The load factor (23·42 per cent.) represented a decline, and was the lowest for the last six years. The average price obtained per unit increased from 2·123d. to 2·218d.

Blackburn.—Proposed Tariff Alterations.—The electrical engineer (Mr. P. P. Wheelwright), in his annual report, says:—"I have given careful consideration to the question whether an alteration in the method of charging would encourage consumption, and have come to the conclusion that this question would repay consideration. At the present time, many householders are considering the installation of electrical appliances for domestic purposes, and are being pushed by enterprising manufacturers and dealers. Owing to the system by which the charge for lighting is kept distinct from that for power, separate connections have to be made, which is a real obstacle to this development. Schemes of charging have been proposed which avoid the difficulty, and I shall be glad if the committee will instruct me to report specially on the subject for their consideration."

Bradford.—Demonstrations for Consumers.—Under the scheme for development of the use of electricity for domestic purposes at Idle and Thackley, the Bradford Electricity Department has opened a temporary showroom at the Old Chapel, Town Gate, Idle. In this connection, and for purposes of general domestic development, demonstrations and lectures on the use of all classes of electric appliances in the home have been given at the Idle showroom, from July 4th to 8th, and at the city showrooms from July 11th to 15th, by Mrs. Reynolds, of the Western Electric Co., Ltd.

Brentwood.—Electric Lighting Order.—The Brentwood District Electric Co., Ltd., has applied for the Council's consent to the granting of an order to supply electricity for public and private purposes within the area, including the urban district. The matter has been referred to a Committee.

Chester-le-Street. — Loan Sanctioned. — The Urban District Council has received sanction to borrow £4,000 in connection with the electric lighting scheme.

Continental. — France. — *The Times* states that the Asnières power station, which supplies the north-western suburbs of Paris, was destroyed by fire on July 8th.

Cookham.—Electric Lighting Order.—Mr. H. Pinder Brown, who is applying for powers to supply electricity to Cookham, has asked for the support of the Rural District Council. The matter is to be considered at a future meeting of the Council.

Giffnock.—Electricity Supply.—The Clyde Valley Electric Power Co. has acquired a site for a sub-station, and work is to be commenced shortly in connection with the supply of electricity to Giffnock.

Glasgow.—Electricity and Gas for Houses.—In a report to the Corporation, the electrical engineer thinks that the best way of dealing with the new housing schemes would be to allot one area to the electricity department, and another to the gas department to save duplication of mains and services. If this were done he estimates that electricity could be supplied at a rate of 2s. per week, plus ½d. per unit consumed. He suggests that each electric house should have one coal fire for the provision of hot water for the whole of the house, and points out that the saving effected in construction would cover the cost of the electrical installations.

Sinking Fund.—It was recently reported that the Electricity Commissioners had intimated that they were prepared to sanction the borrowing of the £1,800,000 desired by the Corporation, on condition that the sum to be set aside for sinking fund be 4 per cent. per annum on the amount borrowed, and without any stipulation as to depreciation. This was agreed to.

Godalming. — Increased Minimum for Public Lighting.—At its meeting on June 28th, the Town Council approved an application from the Urban Electric Supply Co. to permit an increased minimum of £1,000 to be charged, in place of the present minimum of £600. This is equivalent to a charge for 16,000 units.

Hoylake. — Loan. — The Hoylake and West Kirby Council has applied for sanction to borrow £1,000 for mains, services, and tranformers.

Huddersfield.—Area Modification.—The Corporation is applying to the Electricity Commissioners for an amendment of the proposed area of supply under the Huddersfield (Extension to Kirkheaton, &c.), Special Order, by the inclusion of the urban district of Marsden.

Kirkcaldy.—Year's Working.—The annual report for the year 1920-21 of the electricity department records a total income of £40,727, as against £32,221 in the previous year. The total working expenditure was £34,914, as compared with £25,223, leaving a gross profit of £5,813 (£6,998). The net result, after payment of capital charges, was a deficit of £988. In the preceding year there was a net profit of £841. The total number of units sold was £3,785,544, and the average price obtained 2·578d.; the figures for 1919-20 were 3,178,397 and 2·429d.

Leeds.—Effects of Coal Dispute.—In a report upon the effects of the miners' strike, the manager of the Corporation electricity department estimates that the total loss during the whole period amounted to about £18,500. This was brought about to the extent of £16,250 by the high price of the "emergency" coal; the price averaged 52s. 6d. per ton, as against the pre-strike rate of 20s.

Leominster.—Supply from Hereford.—With regard to the supply of electricity to the town of Leominster, by the Corporation of Hereford, the Leominster Town Council last week appointed a deputation to discuss the question with the Hereford Council and electrical engineer at a special meeting.

Liverpool.—Bulk Supply.—The Electricity Committee recommends that an application be made to the Electricity Commissioners for an order to enable a supply of electricity in bulk to be given by the Corporation to the Liverpool District Lighting Co., Ltd., and to authorise the laying of any mains or works in the City of Liverpool, the Borough of Bootle, the Urban District of Litherland, and the Urban District of Waterloo-with-Seaforth, which may be necessary to enable the supply to be given.

London.—Hampstead.—The Borough Council has under consideration the cessation of generating its own electricity, and the conversion of the station to deal with a bulk supply.

It is reported that sanction to borrow £38,693, for works in connection with the St. Marylebone bulk supply has been received from the Electricity Commissioners.

County of London Co.'s Bill.—On Monday, the Bill was read a second time in the House of Commons, after a division. An attempt was made to block its progress, on the ground that it should wait until the Electricity Commissioners had concluded the inquiry which is now in progress, and made an order. Mr. Neal,

Parliamentary Secretary to the Ministry of Transport, stated that the Commissioners had an open mind on the question.

WOOLWICH.—The Borough Council has approved a recommendation of the Electricity Committee to apply for sanction to borrow £28,500 for the following purposes:—Mains, £9,500; services, £8 000; meters, £8,000; hire rentals, £1,500; and hire purchase, £1,500.

Manchester.—BULK SUPPLY.—The Electricity Committee recommends the sealing of an agreement with the Sale Urban District Council for the supply of electricity in bulk to that district.

Newcastle-under-Lyme. — YEAR'S WORKING. — The following are the results of working for the year ended March 31st last of the Corporation electricity undertaking (last year's figures are given in parentheses):—Total revenue, £7,816 (£6,285); working expenses, £5,295 (£4,078); gross profit, £2,521 (£2,207); net profit, £24 (£414). The total number of units sold rose from 264,039 to 303,145. Oil and gas fuel are used in this station, and part of the supply is bought in bulk.

New Zealand.—AUCKLAND.—The Minister for Public Works, Hon. J. G. Coates, said recently that the decision as to which hydro-electric power scheme should be first developed in the Auckland Province now depended upon the investigations as to which proposal would be the best economically—Arapuni, with the new dam proposal, Aratiatia, or two other smaller schemes. The experts would work out the cost of transmission lines and construction work, and the way would then be prepared for a decision. One advantage possessed by Aratiatia, which was mentioned in the report, but was not generally appreciated, was that it could be developed gradually and yet economically. Arapuni, on the other hand, would not be really payable until they had a large development—say, about 40,000 h.p.—*Auckland Weekly News.*

Peterborough. — LOAN. — The Electricity Committee recommends application for permission to borrow £8,776 for the provision of low-pressure mains and feeders.

Richmond.—PRICE INCREASE REFUSED.—The Town Council has refused to allow the Richmond Electric Light Co. to increase its charges. It was stated that the average dividend of the company was 4½ per cent.

Rochdale.—YEAR'S WORKING.—The 1920-21 accounts of the Corporation electricity department show that the total income was £151,959 and the working expenses £105,212, leaving a gross profit of £46,747. After payment of interest and sinking fund charges £28,744, war bonus £1,895, a total of £30,639, less other receipts of £79, there remained a net profit of £16,187, as against £14,321 in the previous year. Of this amount, £7,000 was transferred in aid of the rates, and the balance to the reserve fund. The prices charged for electricity supplied for purposes other than lighting were further increased during the year, and became operative in the March quarter. The amount standing to the credit of the sinking fund is £83,250, an increase of £12,783.

LOAN SANCTIONED.—The Corporation has received the sanction of the Electricity Commissioners to the borrowing of £77,132 for work in connection with the electricity undertaking.

Sheffield.—GERMAN PLANT.—The Corporation's proposal to buy German electrical plant will receive widespread criticism, but it has no option. It requires a new 10,000-kW generating plant. The Amsterdam Corporation can supply this plant, of German manufacture, for £49,900. The lowest British quotation was between £90,000 and £100,000. There was a quotation from Switzerland of £80,000. The contract is subject to approval by the City Council on July 13th. The Electricity Supply Committee suggests that its general manager shall go to Berlin with the chief engineer of the Amsterdam Corporation to inspect the plant.—*Daily Mail.*

Shoreham (Sussex).—APPLICATION FOR ORDER.—Mr. Frank Gibbs, of Beach Shipyard, Shoreham-by-Sea, announces his intention to apply for a Special Order to enable him to supply electricity for public and private purposes within the urban district and the parish of Lancing. It is stated that this will necessitate the revocation of a part of the Brighton Corporation Act, 1903, which gave the Corporation powers of supply in this area and adjacent districts.

Southport.—SALE OF OLD PLANT.—As the whole of the new electricity plant is now in operation, the Electricity Committee recommends that the replaced plant be advertised for sale. As a result of the installation of the new plant, it has been found possible to dispense with the services of two fitters, two fitters' labourers, two stokers, one driver, and one switchboard improver.

NEW MAIN.—The Corporation electricity department intends to commence laying an underground cable to Ainsdale. The purpose is that when the Corporation takes over the Birkdale Supply Co., according to the terms of an agreement, it will have a good main cable on which to rely, as the present cable is old and decayed. The work will be completed by September.

Soyland.—COST OF SUPPLY.—The Urban District Council has received a communication from the Yorkshire Electric Power Co. stating that the company has prepared a preliminary estimate of the cost of supplying electricity in Soyland amounting to £9,000. The company has decided to consider the possibility of reducing the cost.

Swansea.—YEAR'S WORKING.—At a recent meeting of the town Council, the deputy treasurer gave the financial details of the past year's working of the electricity undertaking. The revenue amounted to £106,413, as against £77,391 in the preceding year. Working expenses totalled £80,550, as compared with £56,252, leaving a gross profit of £25,863 (£21,139). Capital charges were much heavier, on account of the capital raised during the year, amounting to £22,036. The net profit was £3,877, as compared with £4,406 in the previous year. It is claimed that the Swansea undertaking is the only one in which charges have not been increased by more than 50 per cent. above the pre-war level, and the results of working have justified the Electricity Committee's policy of keeping prices as low as possible.

United States.—HARNESSING THE COLORADO RIVER.—The plans of the Southern California Edison Co. provide for the impounding of the waters of the Colorado river and developing hydro-electric power on a huge scale for distribution over a wide area of the south-west. It is estimated that the project ultimately will involve $800,000,000, or twice as much as was spent on the Panama Canal. It is contended that among the results of the project, when completed, would be:—Absolute flood control; provision for irrigation of 2,500,000 acres, of which 1,000,000 acres would be above the canyons; 300 miles of the river would be made navigable; the area which could be served with power includes the entire States of Arizona, Nevada, and Utah, more than one-half of Colorado and New Mexico, one-fifth of Idaho and Wyoming, and three-quarters of California, with possible large areas in Northern Mexico; power would be used for the electrification of steam railroads, as well as for commercial, agricultural, mining, and municipal purposes.—*Reuter's Trade Service* (Los Angeles).

Walmer.—TIME EXTENSION APPROVED.—The Urban District Council has agreed to six months' extension being granted to the gas company for carrying out the Electric Lighting Order of 1914.

Warrington.—TEMPORARY PRICE INCREASE.—Owing to the price of "emergency" coal, the Warrington Manufacturers' Association agreed to pay a temporary increase of 1½d. per unit for electricity. It is now stated that the temporary increase will not exceed ¾d. per unit, and it is hoped that the increase will be less than ½d. per unit.

WATER POWER.—The electrical engineer has been instructed to report on the possibility of utilising water power at Woolston Weir for the generation of electricity.

West Bromwich. — YEAR'S WORKING.—The annual accounts of the Electricity Committee show that the total income of the electricity department for the year ended March 31st last amounted to £86,753, compared with £66,231, an increase of £20,522. The expenditure on revenue account was £67,382, an increase of £18,526. The gross profit amounted to £19,371, as compared with £17,354 last year, being an increase of £2,017. After providing for interest and instalments towards redemption of loans, there is a net profit of £7,895 to carry forward. The Electricity Committee has recommended that the balance standing to the credit of the new revenue appropriation account, viz., £3,926, be transferred to the depreciation fund account.

Willesden.—STOLEN ELECTRICITY.—The electrical engineer has reported to the Electricity Committee that his department has discovered an installation which has been connected to the Council's mains since February last—and not connected through a meter. Legal proceedings are to be taken against the person concerned.

Worcester.—EXTENSION OF SUPPLY AREA.—The Electricity Committee has deposited with the Electricity Commissioners a scheme for extending the area of supply to surrounding districts in South Worcestershire.

TRAMWAY AND RAILWAY NOTES.

Australia.—MELBOURNE.—The agreement between the Melbourne City Council and the Melbourne, Brunswick and Coburg Tramways Trust for the supply of electrical energy expired on February 28th. The Council has authorised the renewal of the agreement with the Tramways Board for a further period of three years at an increased charge of £100 per year. The agreement between the Council and the Melbourne Electric Supply Co., relating to the supply of electricity for the Hawthorn and the Prahran and Malvern tramway systems was also authorised to be renewed for three years on the same terms and conditions as before. —*The Age* (Melbourne).

Burnley.—YEAR'S WORKING.—The report of the general manager of the Corporation tramways for the year ended March 31st last emphasises the necessity of relaying the remainder of the track as soon as possible. To illustrate the wear that has taken place on lines that were laid in the years 1901-04, a series of diagrams of the track of various routes has been prepared and published in the report. The financial results were as follows, the previous year's figures being given in parentheses:—Total income, £180,792 (£158,601); working expenses, £168,140

(£137,952); gross profit, £12,652 (£20,649); net deficit, £9,752 (£2,096). The total number of car-miles run (1,774,198) represents a slight decrease upon the total for 1919-20; the number of passengers carried was also smaller by about a million.

Continental.— Italy.— The electrification of the Sampierdarena-Ovada-Alessandria and the Milan-Bologna lines has been authorised. The former enterprise will be carried out by the maintenance department of the State Railways, while the supply of material and the work in connection with the latter will be entrusted to private enterprise. The route of the primary main intended to feed the sub-stations from which the Benevento-Foggia line is being supplied was also approved in principle, the system to be employed being that of direct current at high pressure. This main, which in its turn will be fed by plants belonging to private industry as well as from the plant now under construction by the State Railways, is so planned that it will also serve the Sulmona-Castellamare-Adriatico line and the coast line as far as Foggia when these lines come to be electrified.—*Reuter's Trade Service* (Milan).

Dartford.—Loan.—In connection with the agreement entered into by the Urban District Council with the Bexley Council for the joint operation of the tramways, the Urban District Council has applied to the Light Railway Commissioners for sanction to borrow £2,000 for capital purposes, and £10,000 for repairs and reconstruction of the Dartford track.

India.—Calcutta.—The inquiry held at Calcutta as to the possibility of constructing tube railways in that town has now been completed, and it is understood that, from an engineering point of view, the idea is considered quite feasible.—*Reuter's Trade Service* (Bombay).

Kirkcaldy.—Year's Working.—The total revenue of the tramways department, for the year ended May 15th last, was £40,525, as compared with £35,635 in the previous year. Working expenses amounted to £33,794, as against £25,949, leaving a gross balance of £6,731 (£9,686). The net profit was £621, a considerable decline from last year's profit of £3,720. The number of car-miles run (425,917) was slightly lower.

L.B. & S.C. Railway.— Electrification.—Sir E. Geddes said, in the House of Commons on July 11th, that the electrification scheme of the London, Brighton, and South Coast Railway had not been submitted to him for approval, but the proposals had been before him on a request from that company for State assistance in providing the capital, for which, however, no public funds were available. The scheme had been considered by the Electrification of Railways Advisory Committee, and he was in agreement with its conclusions. The company was fully alive to the importance of proceeding with the electrification of the remaining portion of its suburban system, and at the present time was installing electrical equipment up to Croydon, which was a work of considerable size, and when completed would greatly relieve existing pressure. Future extensions, including the electrification of the main line to Brighton and other places, depended upon financial considerations, and far from the grouping of railways unnecessarily delaying such development, he was of opinion that the formation of a southern group under the terms of the Railways Bill would assist towards that end.—*Daily Telegraph.*

London.—Accident.—On July 8th a collision occurred at Wapping between a Metropolitan Railway electric train and a guard's-van and some trucks which had broken away from a Great Eastern goods train climbing a gradient. The driver of the Metropolitan train and the guard of the Great Eastern train were killed; 13 passengers were injured.

"Underground" Slump. — The Underground Railways of London have experienced a serious falling-off in the number of passengers carried during the first six months of the present year. The decrease amounts to about 20,000,000. The after-midnight services, which were suspended during the coal dispute, are not to be restored, and about 300 men are to be discharged in consequence.

Seaforth.—Track Repairs.—The Seaforth, Waterloo, and Great Crosby tramway track is to be repaired, and agreements have been made for borrowing the sums of £1,416 and £3,158 for this purpose.

Stockton.—Taking Over of Tramways.—Regarding the taking over of that portion of the Imperial Tramways Co.'s system within their areas, Stockton and Thornaby have agreed that each Corporation shall own that portion of the permanent way and overhead equipment which lies within its own borough; the whole of the permanent way and electrical equipment at the Bridge Road and Norton depôts belongs to Stockton, as do also the land and buildings at these depôts; Stockton owns three-quarters, and Thornaby one-quarter of the miscellaneous stock, loose plant, tools, &c., and Stockton takes over 20 cars, and Thornaby nine. The amount due to the company for consumable stores was £24,924, of which Middlesbrough contributed £13,895, Stockton £7,384, and Thornaby £3,645.

Walsall.—Year's Working.—The accounts of the Corporation tramways for the year ended March 31st last show a total income from all sources of £98,056, as compared with £82 534 in the preceding period. Working expenses amounted to £83,802, as against £70,400 in 1919-20, leaving a gross trading balance of £14,254 (£12,134). Capital charges absorbed £11,147, making the net result a profit of £3,107, a large increase on the previous year's figure—£979. The motor omnibus undertaking incurred a net loss of £9,941.

TELEGRAPH AND TELEPHONE NOTES.

Australia.—Wireless Telegraphy.—At the request of the Portuguese Government, arrangements are in progress for opening up wireless communication with Timor, Portuguese East Indies.

Since the occupation of New Guinea by the Commonwealth, the development of radio communication between the mainland and the islands has been rapid. Coastal stations in the north of Australia maintain a reliable service with Rabaul which, in turn, distributes for six or eight smaller wireless stations, originally erected for military purposes, but which are now utilised for public service. Communication is maintained between Cooktown, Samarai, and Misima (British New Guinea), and Port Moresby. Extensive alterations have recently been made to the Townsville station, but further increases are imminent. With the development of the service, certain stations became unnecessary, and the plant at Mt. Gambier (S.A.) and Roeburne (W.A.) was dismantled. It has become possible to meet all present-day requirements by direct working between Brisbane and Perth.

China.—American Wireless Stations.—Replying to an inquiry by the Chinese Minister at Washington, the State Department declares that the United States will support the rights of the Federal Telegraph Co. under its contract with the Chinese Government for the erection of wireless stations at Shanghai and elsewhere, notwithstanding the protests of the British, Japanese and Danish Governments. The Department adds that communications on the subject received from the three protesting Governments tend to confirm the belief that their desire to exclude the American company is "founded upon assertions of monopolistic or preferential rights in the field of Chinese Governmental enterprise which cannot be reconciled with the treaty rights of American citizens in China or the principle of the open door."—*Reuter's Trade Service* (Washington).

American Plant.—It is stated that as regards telegraph and telephone requisites, Danish and Japanese manufacturers control the situation in China. According to the *T. and T. Age*, all the telegraph work is done on tape, and the telegraph sounder is unknown at the present time in China. Chinese characters are transformed into four-numeral combinations, and re-translated at the other end from the Continental numeral dots and dashes on the tape to the written numerals, and translated into the Chinese characters which they represent. The first American telegraph equipment is soon to be installed in the central office at Hankow. It consists of motor-generators, a storage battery plant, and a Western Union type pin-jack switchboard. The same kind of equipment will later be installed at Peking, to take the place of practically nothing in the way of inside switching devices. "When the two installations at Hankow and Peking are completed, no doubt the Chinese authorities will look to America for additional telegraph and telephone apparatus."

Czecho-Slovakia.—Telephone Service.—A revolt of telephone users has occurred owing, says the *Financial Times*, to a new law having been passed under which all who have a Government telephone must buy at least 6,000 kronen (£30) worth of Government bonds, the proceeds to be utilised for the improvement of telephones and telephone lines. Anyone who refuses to buy the bonds will have his telephone cut off.

France.—Wireless Developments.—The report presented at the recent meeting of the Compagnie Générale de Télégraphie sans Fil stated that the company had obtained authority from the Argentine Government to establish and work a large station to ensure communication between Argentina and all countries in the world outside of South America, and the investigations of the technical mission sent out would determine the form and conditions under which this undertaking would be carried out. Similar negotiations were entered into with other South American Governments, and certain of them were concluded early in 1921. The States directly or indirectly interested in the negotiations were those of Ecuador, Colombia, Peru and Venezuela. During the year the company participated in the constitution of the Roumanian company, Radioelectrica, with a share capital of 6,000,000 lei, and the company's licensee in Poland was developing satisfactorily. The Compagnie d'Exploitation Radio-Electrique, which was formed in 1919 specially for the working of ship installations, was yielding favourable results; its scope of action was directed in the first place to the French merchant fleet, and it was now beginning to extend beyond France. The report proceeded to refer to the contract concluded with the French Government last October for the construction and working of two transmitting stations, one for the European continent and the other for transmarine communication, and of one receiving station. The concession was for 30 years from January 1st following the date fixed for the inauguration of the stations, and at the expiration the stations would become the property of the State. As the agreement provided that the company must form a separate company to undertake the work, the Compagnie Radio-France was constituted for this purpose at the end of June, 1921, with a share capital of 60,000,000 fr. All the stations were already in course of construction; the two transmitting stations were rising in the district of Sainte-Assise, near Melun, while the receiving station was being erected at Villecresnes, 15½ miles distant from Paris.

New Zealand.—Wireless Telephony.—The Minister for Public Works, the Hon. J. G. Coates, is considering the use of wireless telephones for lighthouses and other isolated places

South Africa.—WIRELESS TELEPHONY.—The Railways and Harbours Administration is about to install wireless telephone sets at Port Elizabeth and Bird Island. Communication between these two places has hitherto been carried out by means of a pigeon post.—*Reuter's Trade Service* (Cape Town).

The Telegraph Service.—DEFERRED PRESS SERVICE.—The Colonial Office announces that in order to improve Empire communication the Pacific Cable Board is to reinstate the Deferred Press service between Britain and Canada on the one hand, and Australasia on the other.

Wireless Telegraphy.—The Portsmouth correspondent of *The Times* states that the Admiralty is considering the advisability of closing the wireless telegraph stations at Bathurst (Gambia), Demerara, Mauritius, Port Nolloth, and the Seychelles.

Wireless Telephony.—LICENCES.—In reply to a question in the House of Commons the Postmaster-General stated that the use of wireless telephony for ordinary purposes within the United Kingdom was impracticable, because of the unavoidable mutual interference between the various stations. Their objection, however, would not apply to the same extent in the case of communication between this country and abroad, and the issue of licences for the latter purpose was under consideration.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the ELECTRICAL REVIEW *in which the "Official Notice" appeared.)*

OPEN.

Australia.—TASMANIA.—August 15th. P.M.G.'s Department. Switchboard material. (July 8th.)

Battle (Sussex).—July 29th. Union. New accumulator plates for 28 cells. Sizes 16½ in. × 10¾ × 8½ in. (See this issue.)

Belgium.—July 27th. Belgian Post and Telegraph authorities at La Salle Madeleine, Brussels. 45,940 metres of paper-insulated and alloy-tube-covered cable and 8,638 metres of paper-insulated cable, with armoured-lead covering. Particulars may be obtained from the above address for 3½ francs (Cahier de Charges Special, No. 610).

July 31st. Municipal authorities of Arville (Luxemburg). Establishment of an electric lighting system in the town and district. The plans and specifications can be examined at the office of the Secretariat Communale, at Arville, to which address tenders are to be sent. The scheme includes the establishment of a hydro-electric station, on the River Homme, and high and low-pressure mains from the power-station to the distribution plant in the town, a distance of about 4½ miles.

Municipal authorities of Montignies-sur-Roc (Hainaut). A system of primary and secondary electricity mains in the town.

The Department of Overseas Trade reports that a contract for the construction of a 60-km. high-pressure transmission line, in the province of Limburg, has been awarded to a Belgian firm of contractors. United Kingdom firms desirous of supplying material to the successful contractor should communicate with H.M. Consul, British Consulate, Liége, forwarding copies, in duplicate, of catalogues, lists, &c.

Bristol.—August 15th. Corporation Electricity Department. The supply of one 3,000-kW, single-phase, 93-cycle, 2,200-V. turbo-alternator and condensing plant and auxiliaries; and one 6,000-kW, three-phase, 50-cycle, 6,600-V ditto. (See this issue.)

Bulgaria.—July 23rd. The Bulgarian Ministry of Finance, in Sofia, is inviting tenders for a quantity of miscellaneous electric material, including motors, transformers, voltmeters, ampere-meters and fittings for electric lighting and bell installations.

Glasgow.—The District Committee of the Tower Ward of the County of Lanark. Electric lighting for 50 houses to be erected at Gartcosh. Mr. Jas. A. McCallum, District Clerk, 15, West George Street, Glasgow.

The Corporation invites tenders for the passenger lifts required in connection with the extensions to municipal buildings. Plans at Messrs. Watson, Salmond & Gray, architects, 242, West George Street, Glasgow. Tenders to Town Clerk on or before 22nd inst.

London.—Metropolitan Asylums Board. July 20th. Alterations and repairs to the electric lighting, fire alarms and domestic bell installations at St. George's Home, Chelsea. (July 8th.)

Manchester.—July 29th. Electricity Committee. Five 2,500-kW rotary converters and other plant and switchgear. (July 8th.)

August 3rd. Electricity Committee. Low-pressure steam and water pipes and valves for Barton station. (See this issue.)

Mexborough.—July 23rd. Urban District Council. Electricity Department. E.h.p. switchgear; l.p., d.c. switchboard. (July 1st.)

Newport (Mon.).—July 25th. Electricity Department. 750-kW rotary converter, transformer and switchgear. (July 8th.)

New Zealand.—WELLINGTON.—November 1st. Public Works Tender Board. One 200/250 b.h.p. oil engine and one 3-phase, 50-cycle, 190-kW at ·8 power factor, alternator, with exciter and switchgear.*

Warrington.—August 9th. Corporation Electricity Department. Circulating pumps. (See this issue.)

*** A copy of the specification, &c., can be consulted at the Department of Overseas Trade, 35, Old Queen Street, S.W.1.**

CLOSED.

Australia.—SYDNEY (N.S.W.).—The Municipal Council proposes to accept the tender of the English Electric Co., of Australia, for low-pressure oil switches (£5,540), and to invite tenders for non-automatic oil switches.

Birkenhead.—Electricity Committee. Accepted:—

Supply and laying of high-pressure mains from Marshall Street sub-station to Wallasey generating station, £9,942.—W. T. Henley's Telegraph Works Co., Ltd.

Bradford.—Electricity Committee:—

Steelwork for No. 2 engine-room floor, Valley Road works.—H. Barrett and Sons, Ltd.

Transformer chamber building for Scholemoor housing site and district.—F. G. Burgess.

Air outlet for Nos. 5 and 6 turbines at Valley Road works.—F. Fox.

Tramways Committee:—

48 tons of steel tramway rails, at £20 per ton for high silicon rails, and £21 per ton for rails treated by the sorbitic process.—W. Scott, Ltd.

Doncaster.—Town Council:—

Excavating and laying of tramway rails, &c., Balby, £3,712.—G. Percy Trentham, Ltd.

Low-pressure cables, £1,384.—Enfield Ediswan Cable Works, Ltd.

Extra-high-pressure cable, £1,146.—Callender's Cable & Construction Co., Ltd.

Edinburgh.—A contract for cables for the Portobello electric power station (Corporation) has been given to a Belgian firm, whose estimate of £1,287 was £216 lower than any British tender. Councillor Bruce Lindsay stated that the most important part of the machinery for the new Portobello Station came from Switzerland, at a saving of £60,000.

London.—HACKNEY.—Borough Council:—

Electricity works building extensions.—J. Jarvis & Sons, Ltd. (accepted).

Manchester.—Electricity Committee. Approved:—

Three-phase, 6,600-volt sub-station switchgear.—Park Royal Engineering Works, Ltd.

Weldless steel lamp columns.—The British Mannesmann Tube Co., Ltd.

33,000-volt and 6,600-volt sub-station switchgear.—A. Reyrolle & Co., Ltd., and the British Thomson-Houston Co., Ltd.

Three voltage induction regulators.—Maschinenfabrik Oerlikon, Zurich.

Newcastle-on-Tyne.—City Council. Contracts sealed on July 6th:—

Tramway turn-outs and cross-overs.—Hadfields, Ltd., £4,299.

Tramway junctions.—United States Steel Products Co., £18,213.

Electrical installations, Walker Housing Estate.—Fletcher Bros., £517 10s.; Robson & Coleman, £515; Jesmond Electric and General Engineering Co., Ltd., £530; Pinkney & Forster, £505; Wilson & Ridley, £737; R. W. Cairns, £572 10s.; Reid, Ferens & Co., £495; S. Gillitt & Co., £765; Falconer, Cross & Co., £542; T. G. Usher & Co., £529; Devereux, Moodie & Co., £507 10s; E. G. Atkinson, £350; Gray Bros., £260; A. E. Heath & Co., £257 10s.; and G. S. Douthwaite & Co., £252 10s.

Sheffield.—Electric Supply Committee. Recommended:—

10,000-kW plant, £49,900.—B. White-Taylor Marine Corporation.

The plant offered is of German manufacture, and the price includes supervision of the erection of the plant. The tender was considerably lower than any other.

As we go to press we learn from the *Financial Times* that it is unlikely that the Corporation will accept this recommendation, the Committee having asked leave to reconsider the matter.

Spenborough.—Electricity Committee:—

Sub-station switchgear.—To be supplied by Yorkshire Electric Power Co.

Engine-room steelwork.—Leonard Cooper, Ltd.

Cable and house services.—Western Electric Co., Ltd.

Stafford.—Town Council:—

500 yd. high-pressure cable, 19s. 7d. per yd.—Pirelli-General Cable Works, Ltd.

Turton (co. Durham).—Lighting of parish. The following tenders have been received:—

Reid, Ferens & Co., £545; Co-operative Wholesale Society, £595; and the South Hetton Coal Co., Ltd., £4 10s. per lamp.

The last-named company is being approached with a view to securing a reduction in price.

FORTHCOMING EVENTS.

Incorporated Municipal Electrical Association.—Wednesday, July 20th, and following days. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 2.30 p.m. Annual meeting. For details, see "Institution Notes."

Thursday, July 21st. At 7 p.m. At the Hotel Cecil. Annual dinner.

Electro-Harmonic Society.—Wednesday, July 20th. At the Institution of Electrical Engineers, Victoria Embankment, W.C. At 4.30 p.m. Annual general meeting.

NOTES.

The Circulation of the "Electrical Review."—The directors of the ELECTRICAL REVIEW, LTD., desire to draw the attention of their supporters to the certificate of Messrs. W. B. Keen & Co., chartered accountants, appearing on advertisement page Sup. 17 to-day, showing the net sales and total circulation of the ELECTRICAL REVIEW for the six months ended June 30th, 1921. It may be of interest to point out that notwithstanding the disturbed and depressed industrial conditions which have prevailed during the past half-year, the net sales have increased from 12,564 (average copies per week for the last three months of 1920) to 12,682 average per week for the first six months of 1921. Taking into account 777 free copies issued to Foreign Consuls and advertisers, against 717 the previous average, the total circulation now figures at 13,459, as compared with 13,281, indicating steady and gratifying progress in a period of exceptional difficulty.

Service Notes.—Captain R. W. Strugnell, late of the Royal Engineers, has been granted a pilot's commission in the Royal Air Force whilst employed in the Electrical Services Works Co. under the Directorate of Works and Buildings. Captain Strugnell saw service in the late war. Under the age rule, Captain W. E. Hammerton, T.D., London Electrical Engineers (Territorial Force) has retired from that corps, with which he was long and honourably associated. Captain Hammerton was a lieutenant of six years' service in the corps when he got his captaincy in July, 1914, the month before the war broke out. Warrant electrician A. C. Cornhill joined the battle cruiser *Glorious* on the 1st inst. for a turn of duty. Warrant telegraphist G. H. Carkeet has been appointed to the battle cruiser *Queen Elizabeth* as assistant to the fleet wireless officer from 1st inst.

Fatality.—To reach a bird's nest in the roof of an outhouse at Castleloan, Linlithgowshire, Alex. Banks, aged 13, climbed an overhead transmission pole and grasped a conductor carrying electricity at a pressure of 3,000 volts. His hand was burned, and he fell to the ground, and soon afterwards died.—*Daily Mail.*

Educational.—UNIVERSITY COLLEGE, LONDON.—The following awards have been made in the Faculty of Engineering:—

Andrews Scholarship (First year).—B. W. Huntsman.

Goldsmid Entrance Scholarship (Second year),—L. W. Ball.

Archibald P. Head Medal and Prize.—F. W. Neville.

L. F. Vernon-Harcourt Prize (Civil Engineering).—A. I. W. Jones and J. P. Porter (equal).

Chadwick Medal and Prize.—J. P. Porter.

Diplomas in Electrical Engineering have been obtained by the following:—E. F. Anderson, H. E. M. Barlow (with distinction), J. R. Harding, R. A. E. Parsons, V. W. Roskilly.

CAPE TECHNICAL INSTITUTE, CAPE TOWN, S.A.—A Department of Electrotechnics has been formed at the Cape Technical Institute, and over 50 students are in attendance. Laboratory classes have been started with an outlay of £83 on equipment, which is being supplemented with apparatus constructed by the students; it is believed that before long larger funds will be available for this purpose, but in the meantime the department is badly in need of a few sensitive galvanometers. An electric supply of 25 h.p. d.c. and 25 h.p. three-phase has been proposed for the electric laboratory in the new buildings, which are being constructed. At present the classes are being conducted in temporary buildings. If any British electrical firms have small plant or apparatus to spare, which they could present to the Institute, the gift would be greatly appreciated, and would, moreover, constitute a valuable advertisement. Apparatus which has become obsolete for the general market, but is otherwise in good order, is often of great value to a technical college, and it could not be disposed of to better advantage; the young student carries through life the impressions received during his college days, and amongst these should be the names of British makers of electrical apparatus.

The foundation stone of the new Institute was laid on May 26th, by Prince Arthur of Connaught, Governor-General, and a public appeal was made for equipment. The electrical students have raised £50, and their instructor, Mr. N. C. Woodfin, invites manufacturers of electrical apparatus and plant to send him catalogues and price lists.

Joint Electricity Authorities' Finance.—At the annual conference of the Institute of Municipal Treasurers and Accountants, recently held in Buxton, Mr. Alfred B. Dawson, A.S.A.A., the accountant to the St. Annes-on-the-Sea Urban District Council, submitted a well-reasoned paper on the financial aspect of the proposed electricity supply areas, in the course of which he put forward proposals for dealing with existing generating stations, the method of payment for existing stations, the financing of the capital requirements of the Joint Electricity Authority, the advantages and disadvantages of the super station, and the linking up of existing undertakings.

As a result of the examination of the question, he had formed the impression that for the first few years the "super" stations would not be able to supply so cheaply as many of the existing stations, principally because during the early period of their existence they would be heavily capitalised. On the other hand, he believed that when the district boards or joint electricity authorities were relieved of the debt of the existing stations, and when the load approached within reasonable distance of the capacity of the super stations they would prove to be more economic and eventually result in a cheap supply of electricity.—*Municipal Journal.*

Appointments Vacant.—The Liverpool Tramways and Electricity Committee has decided to advertise for a rolling stock and works superintendent, at an inclusive salary of £750 per annum.

The following vacancies are advertised in this issue:—Distribution engineer (salary according to E.P.E.A. schedule commencing at Grade 3, Class E.), for Croydon Corporation; three shift engineers (£231), for Dover Corporation; chief assistant engineer (£450), for Coventry Corporation.

The Electricity (Supply) Bill.—It is reported in the lay Press that the Government, anxious to avoid the necessity of an autumn session, has decided to defer the consideration of a great deal of new legislation, including the Electricity (Supply) Bill.

Engineering Wages.—The result of the ballot upon the new terms, arranged between the two parties in the engineering industry, was announced on July 13th. The figures were:—For acceptance, 175,145; against, 108,969; a majority of 66,176. The proportion of votes to the number of ballot papers issued was again small, only about a quarter of the men voting. It is stated that the voting of every constituent trade union of the industry showed a majority in favour of the terms.

Electrical Trades Benevolent Institution.—The E.T.B.I. has received from the Cardiff Local Advisory Committee a cheque for £76, the proceeds of a whist drive and dance organised by the Local Branch of the Electrical Contractors' Association, and held on March 4th.

Institution Notes.—Incorporated Municipal Electrical Association.—The Council has decided to allow time at the annual meeting to be held in London next week for the papers, prepared for the Dundee Convention, to be read in extract and discussed. The programme is as follows:—

Wednesday, July 20th. 2.30 p.m.—Presidential Address, by Major H. Richardson, F.R.S.E., general manager and engineer of the Dundee Electricity Supply Department.

2.45 p.m. Paper on "Questions Arising in the Consideration of the Financial and Business Aspects of Municipal Electricity Supply," by Mr. C. W. Charlesworth, Electricity Supply Department, Wolverhampton.

A meeting of the Chairmen Members (only) of the I.M.E.A. will be held immediately following the above paper.

Thursday, July 21st. 10 a.m.—Papers on (*a*) "Steam Raising—Yesterday, To-day and To-Morrow," by Mr. D. Wilson (Messrs. Babcock & Wilcox).

(*b*) "Modern Boiler House Practice," by Mr. W. M. Miles, Electricity Supply Department, Sheffield.

2.30 p.m.—Paper on "Present Day and Commercial Problems in Electricity Supply," by Mr. E. Cross, Rotherham.

Friday, July 22nd. 10.15 a.m.—Annual general meeting.

The meetings will be held at the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, W.C., unless the inquiry which the Electricity Commissioners are holding is still in progress, in which event the meetings will be held at the Institution of Mechanical Engineers, Storey's Gate, S.W.

The annual dinner of the Association, at which ladies will be present, will take place at the Hotel Cecil, Strand, W.C., on Thursday, July 21st, at 7.30 p.m. (reception 7 p.m.).

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

ACCORDING to *The Times*, MR. A. L. TACKLEY has been appointed an electrical inspector of factories.

The marriage took place last week at Stourbridge, of MR. DENNIS G. F. HOLMES, M.M., electrical engineer, of Amblecote, and Miss Adelaide Walton.

In confirming the appointment of MR. HAWKINS, of St. Helens, as the new borough electrical engineer of Wallasey, there was a discussion as to whether he should be paid a salary of £900, and be allowed to take two articled pupils, or whether he be given a salary of £1,000, and not be allowed to take articled pupils. The view was expressed that it was in the interests of the undertaking that the Corporation should have pupils, who would be a good class of young men from the universities. The former proposition was adopted.

MR. F. E. FRAMPTON, who has been engineer and manager at the works of the Paignton Electric Light and Power Co., Ltd., for over 11 years, has resigned, and MR. A. E. BAKER, who has been assistant engineer for nearly 10 years, has been appointed in his place.

On Wednesday last week the permanent staff of the London Chamber of Commerce presented MR. C. E. TOWN, the recently retired assistant secretary of the Chamber, with a very handsome and large antique mahogany bookcase.

The Bradford Education Committee has appointed MR. P. G. SPARY, of Southampton, as lecturer in electrical engineering at the Technical College, at an inclusive salary of £450, rising to £520 per annum, the salary to be re-considered when salaries are considered after the appearance of the Report of the Burnham Committee, and to be amended accordingly if the Burnham scale operates in Mr. Spary's favour. In the event of Mr. Spary not

taking up the appointment, the chairman and the Principal of the College were authorised to make a fresh appointment.

MR. WILFRID PLANT, electrical engineer, late of the Dockyard, Invergordon, has secured the appointment as burgh electrical engineer at Tain, in connection with the new electric lighting scheme.

The Manchester Corporation Electricity Committee recommends that the salary of MR. W. G. MCCRACKEN, resident engineer at the new Barton station, be advanced from £450 to £600 per annum.

MR. G. E. L. ROWORTH, lately with the Dowsing Radiant Heat Co., Ltd., has been appointed manager of the electrical department of the Edinburgh branch of the Medical Supply Association, Ltd., 12, Teviot Place, Edinburgh.

Obituary.—LORD BALFOUR OF BURLEIGH.—We regret to record the death of Lord Balfour of Burleigh, which occurred in his sleep on July 6th, at the age of 72 years. The deceased peer had a political and financial career of great distinction. He had helped in the settlement of many industrial disputes, and was a member of numerous Commissions and Committees. It will be remembered that he was chairman of the Committee which reported upon "Trade Policy After the War." He was also a director of various companies, including the Western Telegraph Co., and he was a trustee of the Submarine Cables Trust.

MR. C. E. TAYLOR.—The death occurred recently, at Darlington, of Mr. Cyril Ernest Taylor, of the North-Eastern Railway Co.'s electrical department. Mr. Taylor joined the service in 1898, being in charge of the electrical machinery at York and Sheldon. Subsequently he removed to Newcastle-upon-Tyne to superintend the electrification of the branches to the coast. He was an Assoc.M.I.E.E.

MR. A. W. SCLATER.—We regret to record that Mr. A. W. Sclater, electrical engineer, 6, Cork Street, London, W. 1, died suddenly at Saxby, Lincolnshire, on June 25th, aged 55. His main business was installing generating machinery for lighting and power on country estates. Since he started 30 years ago he had put down a large number of plant, many of them being in the historic mansions of this country; among them was Chequers, lately presented by Lord Lee to the nation for the use of the Prime Minister. Mr. Sclater was consulting engineer to the Honourable Society of Lincoln's Inn, and to the Warden and Fellows of Winchester College. The business is being carried on under the same title by his son, Mr. Frank Sclater, with whom he had been associated for some years.

MR. E. C. MILLS.—The death occurred on July 3rd, at the age of 61 years, of Mr. Ernest Charles Mills, chief electrician to Apperly, Curtis & Co., Ltd., Dudbridge Mills, Stroud (Glos.).

MR. JOSEPH WILKINSON.—We regret to record that Mr. Joseph Wilkinson, late tramway electrical engineer to the Hull Corporation, passed away suddenly on July 7th at his residence, 4, Morpeth Street, Hull. He had suffered from heart trouble, and for some years had been living at Withernsea, and it was on his return therefrom that he had a seizure which proved fatal. Mr. Wilkinson was 53 years of age. He retired from his office under the Hull Corporation two years ago, and has since practised as a consulting electrical engineer. Latterly he had been introducing electric battery vehicles into Hull. Mr. Wilkinson served his apprenticeship with Messrs. Cox-Walker & Co., at Darlington, and after being for a time with Messrs. J. H. Holmes & Co., he continued his studies at the Durham College of Science. He had a good deal of practical experience in the lighting of ships at Home, and supervised the electrical equipment of a torpedo boat for the Chilean Navy. He was for some time in the early nineties of last century assistant engineer to Messrs. Siemens Bros. & Co., Ltd. He also went to Hobart, Tasmania, to equip the electric tramway system, and on his return, after two years, he became resident engineer for Messrs. Siemens Bros., in connection with the equipment of the Blackburn tramways. In 1899 he was chief assistant for the contractors on the equipment of the Hull tramways, and in 1903 he was appointed tramway electrical engineer. Mr. Wilkinson was a M.I.Mech.E., M.I.E.E., and a member of the I.M.E.A.

Will.—The late MR. H. GREEN, ironmonger and electrical engineer, of Okehampton, left £27,679.

NEW COMPANIES REGISTERED.

Gaunt & Wilkinson, Ltd. (175,555).—Private company. Registered July 5th. Capital, £500 in £1 shares. To adopt an agreement with T. Gaunt and J. A. Wilkinson, and to carry on the business of mechanical and electrical engineers, steel manufacturers and workers, founders, smiths, &c. The first directors are: T. Gaunt, 56, Chantry Road, Sheffield, engineer; J. A. Wilkinson, 29, Selborne Road, Sheffield, engineer; S. Berrisford, 100, Sharrow Road, Sheffield, engineer. Qualification, £1. Remuneration as fixed by the company. Registered office: Pilot Works, Corporation Street, Sheffield.

S. Rowland & Co., Ltd. (175,599).—Private company. Registered July 7th. Capital, £3,000 in £1 shares (1,150 "A," 650 "B," and 1,200 "C" shares). To carry on the business of coverers of wire with all materials, manufacturers of and dealers in metals, alloys and substances, and coverings therefor, braid and woven goods in all textures, warehousemen, &c., and to adopt an agreement with S. Rowland. The permanent directors are: L. Maister, 60, Osbaldeston Road, Stoke Newington, N. 16; M. Cooper, 58, Osbaldeston Road, Stoke Newington, N. 16 (both directors of Barmaico, Ltd.); A. Simon, 39, Coborn Street, Bow, E.; S. Rowland, 259, Burdett Road, E. 14. Registered office: 8, Strype Street, Middlesex Street, E. 1.

Olsen Engine Syndicate, Ltd. (175,524).—Private company. Registered July 2nd. Capital, £24 in 1s. shares. To acquire from S. D. Olsen the benefit of certain existing inventions relating to the production, treatment and application of electric, steam, petrol, oil, gas, compressed air or other power, &c. The subscribers (each with one share) are: E. I. V. Earle, 2, Staple Inn, W.C. 1, merchant; T. W. Gouding, 2, Staple Inn, W.C. 1, merchant. The first directors are not named. Qualification, 50 shares. Registered office: 2, Staple Inn, W.C. 1.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Aladdin Renew Electric Lamp Corporation, Ltd.—Issue on June 24th, 1921, of £1,300 debentures, part of a series already registered.

Electrical Appliances (Blackpool), Ltd.—Two mortgages dated June 24th, 1921, to secure £700 and £300 respectively, charged on certain lands and premises in Blackpool. Holder: E. Jones, 3, Saville Road, South Shore, Blackpool.

High Temperature Generators (1918), Ltd.—Debenture dated June 16th, 1921, to secure £800, charged on 11 superheater machines and proceeds of sale thereof and company's undertaking and other assets. Holder: W. A. Tompkins, 10, Westleigh Road, Leicester.

Pirelli-General Cable Works, Ltd.—Mortgage dated June 10th, 1921, to secure £15,825, charged on Eastleigh Stores Distributing Park, Eastleigh, Hants., ranking in priority to prior trust deed securing £300,000. Holders: Secretary of State for War, Whitehall, S.W.

Bath Electric Tramways, Ltd. (74,278).—Return dated May 19th, 1921. Capital, £230,000 in £1 shares (75,000 preference, 125,000 preferred ordinary, and 30,000 deferred). 75,000 preference, 75,606 preferred ordinary and 30,000 deferred shares taken up. £150,606 paid. £30,000 considered as paid. Mortgages and charges, £147,517

Sterling Telephone & Electric Co., Ltd. (101,415).—Capital, £65,000 in 40,650 preference and 15,350 ordinary shares of £1 each. Return dated April 5th, 1921. 39,500 preference and 15,350 ordinary shares taken up. £24,500 paid. £30,350 considered as paid. Mortgages and charges, nil.

CITY NOTES.

Calcutta Tramways Co., Ltd.

At the annual meeting held on Monday in London, Mr. John G. B. Stone, who presided, said that the traffic receipts showed an increase of 6¼ per cent., with practically the same number of miles run, the passengers carried (nearly 53¼ millions) showing an increase of 6 per cent. The Indian expenditure showed an increase under all heads. Apart from the advances in wages and salaries, the principal items of increase were power expenses, due to enhanced prices paid for coal, and maintenance and repairs, due to exceptionally heavy repairs on the rolling stock and to abnormal expenditure in making good damage to the electrical equipments of no fewer than 67 motor-cars caused by the floods in August last. The speaker referred to the experience of the company with regard to strikes and wages. The result was that the wages had increased about 33 per cent. for 1920 over the normal total for 1919, while the current year, which would represent a complete year, would show an increase of over 60 per cent. compared with the same period. With this heavy increase in the cost of working it was no longer practicable to carry the public at existing fares, and a new scheme of fares was now under the consideration of the board, and would be brought into operation as quickly as possible. The loss of revenue due to the strikes, coupled with the drop in the takings for the current year from other causes, had drained the company's available cash resources, already depleted by the overspent capital account, and further capital would require to be issued. In the meantime arrangements had been made with the bankers. As regarded their prospects for the current year, although the aggregate receipts to date showed a considerable decrease, it was due to the heavy trade depression and to a variety of causes, all of which were of a temporary nature. There were not wanting signs of improved trade conditions, which a good monsoon would help to develop, and to which their traffic would quickly respond.

Melbourne Electric Supply Co., Ltd.

At an extraordinary general meeting held on Monday at Winchester House, E.C., resolutions were passed transferring the control and management of the company from London to Melbourne. Mr. J. B. Braithwaite presided, and said that the meeting was the result of the action of the Chancellor of the Exchequer and the Government in insisting on making companies which were engaged in developing the resources of the Colonies, and the whole of whose profits were made in the Colonies, subject to British income tax. The only effect would be to discourage the investment of British capital in the Colonies, and although at the moment the Colonies were fairly well supplied with capital from their own resources, the time would come when they would be glad of more British capital. They would then find that the action which the British Government had taken would be greatly to their disadvantage. The board had done all it possibly could, but the only result had been to obtain a certain modification, which did not touch the main question—namely, that a company like theirs, which earned the whole of its profits in Melbourne, was made liable for British as well as Australian income tax. He had suggested to the Government that the sensible solution of the problem was that the shareholders resident in Great Britain should be subject to British income tax, that those resident in Australia should be subject to Australian income tax, and that certainly the company's profits themselves should not be subject to British income tax. This meeting had been called on the initiative of the Australian shareholders. If the resolution were passed the result would be that from July 31st the company would cease to be liable for British income tax, but, as a British registered company, it would still be liable to the new corporation tax. The Australian debenture holders would be free from liability for British

income tax. The directors made a point, in the prospectus of the recent issue of preference shares, of the provisions in the Finance Act which gave the holders special benefit in connection with income tax allowances, but since that prospectus was issued an action had been decided to the effect that preference shareholders subject to double tax were not entitled to participate in the relief granted by Section 27 of the Finance Act of 1920. The result of the transfer would be to improve the position of all classes of the company's securities.

General Electric Co., Ltd. The directors report that the net profits for the year ended March 31st, 1921, are £796,149, to which is added the balance brought forward from last account, less E.P.D. to March 31st, 1920, £175,668, giving a total of £971,817. After deducting debenture stock interest £8,000; depreciation £157,915; contribution to pension fund £17,266; dividend 6½ per cent. per annum on "A" preference shares for the year £107,626; dividend 7½ per cent. per annum on "B" preference shares for the year £121,718, there remains an available balance of £559,291. A dividend at the rate of 10 per cent. per annum, free of income tax, on the ordinary shares for the year is recommended, requiring £211,197, and there is to be carried forward, subject to E.P.D. (if any), and corporation profits tax, £348,094. The satisfactory results of the year's trading show that the additional capital obtained at the close of the last financial year is being employed usefully. The general decline of trade throughout the country during the latter half of the financial year did not immediately affect the electrical industry. Contracts in hand assisted in keeping the majority of the company's works fully employed up to March 31st. The results of the company's overseas branches have in nearly all cases been satisfactory, though they have suffered from exchange difficulties. The allied and subsidiary companies have shown good progress and continue to make a considerable contribution to the company's profits. The number of employés increased during the year, and on March 31st totalled over 16,000. Owing to the present state of industry, the directors consider the usual allocation to reserve out of profits inadvisable, and recommend that the amount which they would have allocated under normal conditions, should remain in the "carry forward" to next account, which thus stands at the total of £348,000. They feel all the more justified in making this recommendation as the reserve account has benefited during the year by the sum of £257,016, through the transfer of net premiums received on the share issue of March, 1920, thus making the total of this account over £700,000. The assets of the company as shown in the balance sheet amount to over £11,000,000, an increase of approximately £4,000,000 upon last year's figures. The considerable increase in the fixed assets is mainly accounted for by the absorption of the Peel Conner Co. with its works at Manchester and Coventry, the further large extensions to the engineering works at Witton, and the Osram works at Hammersmith, and the completion of the building in Kingsway. These additions were all approaching completion on March 31st, and have been carried out by considerable financial assistance from the company's bankers, which liability has been met since the close of the financial year by a debenture issue. The item "sundry debtors" also shows a substantial increase, which is partly due to the expansion of the company's trading operations and partly to the refilling of the depleted stores of the overseas companies, owned or controlled by this company. "Stock-in-trade and work in progress" valued in the usual manner show a large increase, which is accounted for to a considerable extent by work in progress for actual orders. Mr. M. Solomon has been appointed managing director of the Pirelli-General Cable Works, Ltd., one of the company's allied organisations, and has resigned from the board of the company in order to devote his whole time to the work involved. Mr. M. S. Conner, formerly managing director of the Peel Conner Telephone Works, Ltd., which is now the property of the company, has joined the board, and his appointment will be submitted to the shareholders for their confirmation.

Annual meeting: July 21st, at Magnet House, at 12 o'clock.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 148a:—

North Metropolitan Electric Power Supply Co.—£228,460 7½ per cent. debenture stock, redeemable, issued at 95 per cent., of which £35 is paid and fully paid, after issue of allotment letters.

Southern Brazil Electric Co.—£80,000 6 per cent. mortgage debentures of £100 each (redeemable), Nos. B 1,021 to B 1,820.

The undermentioned securities have been ordered to be quoted in the Official List:—

English Electric Co.—£1,250,000 8 per cent. six-year secured notes of £100 each, Nos. 1 to 12,500 (registered).

Southern Brazil Electric Co.—£180,000 6 per cent. mortgage debentures, Nos. A851 to 1,004, A1,049 to 1,086, A1,091 and 1,092 of £500, B1,001 to 1,820 of £100, C501 to 518 of £50, and D1,001 to 1,005 of £20.

St. James's & Pall Mall Electric Light Co., Ltd.—The directors have declared an interim dividend at the rate of 7 per cent. per annum on the preference shares and 7 per cent. per annum on the ordinary shares for the half year ended June 30th.

Trowbridge Electric Supply Co., Ltd.—At the annual meeting a dividend of 7½ per cent. on the ordinary shares was agreed to. The chairman said that the result of the year's working was very satisfactory.

New Issues.—In connection with the issue of 7½ per cent. debenture stock of the *North Metropolitan Electric Power Supply Co.*, the amount of stock offered for subscription was £228,460. There were 3,254 applicants for £2,534,485 stock. These applications included 2,245 each for £500 or less.

Electric Supply Corporation, Ltd.—After transferring £7,196 to repairs and renewals fund, and including £621 brought forward, accounts for 1920 show available balance of £3,403. The directors propose to place £3,000 to reserve fund and to carry forward £403.—*Financial Times.*

Telegraph Construction & Maintenance Co., Ltd.—An interim dividend of 6s. per share, free of tax, is announced.

STOCKS AND SHARES.

TUESDAY EVENING.

SHOULD it turn out that the Bank Rate is not reduced this week, but is left at 6 per cent., there will be disappointment in the various City circles that are looking, this Tuesday evening, for a possible 5 per cent. minimum to be announced on Thursday. From the point of view of the Money Market only, there is little to hinder a reduction, and the Treasury will welcome a step that will fillip the new 5½ bonds now on offer at 97. Nevertheless, the prospect of cheaper money is exerting no great influence over Stock Exchange prices or business, the former continuing rather dull, while the latter has been as languid as the weather.

The North Metropolitan Electric Power Company's issue of £223,000 7½ per cent. debenture stock was subscribed nearly ten times over. The applications for amounts below £500 were in themselves sufficient to have absorbed the issue, without taking into account the larger sums. Dealings started in the market at a premium of 3 points above the issue price of 95, and the price stiffened to 3½ premium later.

General Electric new debenture stock has hardened to 5s. discount, which compares with 4 discount to which the price fell as the stags, and some of the underwriters, hastened to get out after the allotment. The company's report shows a net profit of £613,000, or £120,000 more than that of the preceding year. The dividends on ordinary and preference shares require an additional £200,000 this time, owing to the increase in the capital, the ordinary dividend being maintained, as already announced, at 10 per cent. free of tax. The report led to a rise to 21s. 10½d. in the ordinary shares.

Central London Railway stocks maintain their substantial rises secured this month, but Districts have gone back to 17, Metropolitans to 25, while Underground Electric Railways £10 shares, after being 54s., reacted to 2½. The Income Bonds hold steadily to 83½. Home Railway stocks, as a whole, make an irregular showing. While the higher-priced descriptions attract a few buyers, the other stocks are depressed. What may be the outcome of the Railways Bill, none even of the market authorities seem eager to prophesy, so that it is not surprising for the investor in the street to show more reluctance than ever in the matter of touching Home Railway stocks.

Prices in the cable market slacked off a little towards the end of last week, continuing the process which started at the beginning of the month. At the slightly lower levels, however, investment again took the market in hand, with the result that Eastern ordinary is better at 165½, and Eastern Extensions, together with Westerns and Globe ordinary, have all risen to 16½. Great Northerns at 25¾ are 10s. higher. United River Plate Telephones at 5 11/16 are 1/16 up, and the only retrograde movement in this list is ¼ fall in Chile Telephones to 4¾. Marconi's remain about 2 3/16. The report of the Marconi Marine Co. is due at any moment, and there is considerable curiosity as to what results the profit and loss account will show. The accounts of the Marconi Co. itself are expected about the end of this month. Marines are 25s. 6d., Canadian Marconis 7s. 9d., and the two Radio shares stand at 10s. 6d. and 9s. 3d. for preferred and common respectively.

Cable manufacturing shares are all very steady. There is not a change in the list. Two or three of the companies are still said to be contemplating new issues when the times become more propitious; in other words, when a fall in the Bank Rate enables them to make an appeal for money on terms less onerous than would have to be paid during the first six months of the current year. The Crompton report announces a profit for the year ended March 31st last of £66,000, which is about £13,000 better than that for the previous twelve months. The company pays 10 per cent. on the ordinary and preference shares. Cromptons have been practically absorbed by Armstrongs, but the ordinary shares are still quoted in the Stock Exchange at 16s. 3d., and the preference at the same level, while the 6 per cent. first mortgage debentures stand at 80 ex the interest due July 1st.

The Monterey Light & Power Co. issues details of the proposed plan for reorganisation of the company, whereby arrears of interest due to holders of the first mortgage debenture stock will be funded. The first debenture stockholders are asked to

give up one-sixth of their nominal capital, receiving in exchange new securities payable, at their option, in Canada in dollars or in London in sterling. The scheme is somewhat intricate. The debenture holders are offered in exchange for each £100 of their stock three different securities, plus a cash payment in sterling of the equivalent of 5 dollars. The meeting at which the scheme will be submitted is to be held on July 28th. The price of the stock has risen 3 points this week to 23, comparing with 50½ at which it stood on the eve of the outbreak of war. Other Mexican issues are quiet, awaiting further news from Mexico. Brazilian Tractions have receded to 31. British Columbia Electric stocks are a little irregular. Victoria Falls 5½ per cent. second mortgage debentures nave hardened to 97¼ ex interest, the preference shares remaining at 16s. 3d., around which price there is a fair amount of business being done in them. Canadian General Electric Common are 5 points higher at 130, and the preferred 4 up at 118. Dollar stocks are mostly better, owing to the way in which the value of the pound sterling has dwindled, in relation to the dollar.

Electric Lighting shares are a firmer market. Rises have occurred in City of Londons, Westminsters, South Londons and Metropolitans. The 7½ per cent. Extension debenture stock of the Metropolitan Company has risen to 5¼ premium. The scrip is £40 paid. City of London new ordinary at 23s. and the second preference at 22s. 3d. are both rather better. Siemens new 10 per cent. preferred have hardened to 22s. 3d. Central Electric 8 per cent. Notes keep firm at 102, which is 5 premium over the issue price. Melbourne Electric ordinary at 112½ is 7½ higher on the week. The end of the coal-strike is quoted as one reason for the strength shown by the market for home electricity shares. Engineering and kindred issues exhibit no particular movement. Rubber shares are the turn better upon a slender rally in the price of the product, on buying reported to emanate from America.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1919.	Dividend 1920.	Price July 12, 1921.	Rise or fall.	Yield. £ s.	p.c.
HOME ELECTRICITY COMPANIES.						
Brompton Ordinary	12	12	6	—	£10 0	6
Charing Cross Ordinary	7	8	8½	—	10 6	8
do. do. do. 4½ Pref.	4½	4½	8	—	7 10	6
Chelsea	4	6	8¼	—	9 4	8
City of London	13	14	1½	+ 1/16	11 4	0
do. do. 6 per cent. Pref.	6	6	17/-	—	7 1	2
County of London	9	9	8½	—	9 17	0
do. do. 6 per cent. Pref.	6	6	8½	—	7 7	8
Kensington Ordinary	7	9	4¼	—	10 18	2
London Electric	2½	2½	1	—	7 10	0
do. do. 6 per cent. Pref.	6	6	2¾	—	10 18	2
Metropolitan	6	7	5¾	+ ¼	9 13	2
do. 4½ per cent. Pref.	4½	4½	2½	—	7 18	2
St. James' and Pall Mall	12	12	6	—	10 0	0
South London	6	7	5¾	+ ¼	10 13	4
South Metropolitan Pref.	7	7	15/9	—	8 17	10
Westminster Ordinary	10	10	6¼	+ ¼	9 6	0
TELEGRAPHS AND TELEPHONES.						
Anglo-Am. Tel. Pref.	6	6	84½	+1	7 2	9
do. Def.	1½	1½	16¾	—	9 1	10
Chile Telephone	6	6	4⅞	— ¼	6 3	0
Cuba Sub. Ord.	7	7	7⅜	—	9 6	8
Eastern Extension	10	10	16⅜	—	6 1	3
Eastern Tel. Ord.	10	10	166½	+1	6 10	0
Globe Tel. and T. Ord.	10	10	16½	+ ¼	6 1	3
do. do. Pref.	6	6	90xd	—	6 11	6
Great Northern Tel.	22	24	25⅝	+ ¼	9 6	4
Indo-European	10	10	30	—	8 6	8
Marconi	25	—	2 3/16	—	—	
Oriental Telephone Ord.	12	12	2 1/16	—	*5 16	3
United R. Plate Tel.	8	8	5 11/16	+ 1/16	*7 0	3
West India and Panama	Nil	Nil	6/8	—	Nil.	
Western Telegraph	10	10	16½	+ ¼	*6 1	3
HOME RAILS.						
Central London Ord. Assented	4	4	49½	—	8 1	8
Metropolitan	1½	1½	25	—1	6 0	0
do. District	Nil	Nil	17	—1	Nil	
Underground Electric Ordinary	Nil	Nil	9⅜	— ¼	Nil	
do. do. "A"	Nil	Nil	7/-	—	Nil	
do. do. Income	4	2	£3½	+2	2 8	0
FOREIGN TRAMS, &c.						
Anglo-Arg. Trams, First Pref.	6½	12½	2¼xd	—	10 0	0
do. do. 2nd Pref.	Nil	5½	2¾	—	9 11	4
do. do. 5 % Deb.	5	5	65½	—	7 12	8
Brazil Tractions	Nil	Nil	31	—1	Nil	
British Columbia Elec. Rly. Pfce.	5	5	18	+ ¼	8 12	4
do. do. Preferred	5	4⅔	55	—1½	*8 12	8
do. do. Deferred	3	6	5½	—1	*10 16	2
do. do. Deb.	4½	4½	59½	—	7 2	10
Mexico Trams 5 per cent. Bonds	Nil	Nil	32½	—	Nil	
do. 6 per cent. Bonds	Nil	Nil	29½	—	Nil	
Mexican Light Common	Nil	Nil	11½	—	Nil	
do. Pref.	Nil	Nil	18½	—	Nil	
do. 1st Bonds	Nil	Nil	72½	—	Nil	
MANUFACTURING COMPANIES.						
Babcock & Wilcox	15	16	9⅜	—	3 14	6
British Aluminium Ord.	10	10	15/9	—	12 14	0
British Insulated Ord.	15	—	1½xd	—	9 12	0
Callenders	15	15	1⅞	—	10 8	8
„ 6½ Pref.	6½	6½	17/6	—	7 8	7
Crompton Ord.	10	10	16/3	—	12 6	
Edison-Swan	10	—	10/6	—9d.	—	
do. do. 5 per cent. Deb.	5	5	£8xd	—	7 7	1
Electric Construction	10	10	16/3	—	12 6	2
English Electric	8	8	12/6	—	12 16	9
Do. Pref.	6	6	15/-	—	8 0	0
Gen. Elec. Pref.	6½	6½	16/-xd	+6d.	8 2	6
do. Ord.	10	10	1⅝	—1/16	*9 3	0
Henley	15	15	1⅞	—	10 8	0
do. 4½ Pref.	4½	4½	8½	—	6 18	—
India-Rubber	10	—	13	—	—	0
Met.-Vickers Pref.	8	8	11½	—	8 16	10
Siemens Ord.	10	10	1½	—	*8 17	8
Telegraph Con.	20	20	20½	—	*5 17	1

* Dividends paid free of Income Tax.

MARKET QUOTATIONS.

It should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general, and they may vary according to quantities and other circumstances.

Tuesday, July 12th.

CHEMICALS, &c.	Latest Price.	Fortnight's Inc. or Dec.
a Acid, Oxalic per lb.	9½d.	½d. dec.
a Ammoniac Sal per ton	£75	..
a Ammonia, Muriate (large crystal) „	£65	..
a Bisulphide of Carbon ..	..	..
a Borax ..	£34	..
a Copper Sulphate ..	£31	£2 dec.
a Potash, Chlorate .. per lb.	7d.	..
a „ Perchlorate .. „	8d.	..
a Shellac .. per cwt.	£17	£3 10s. dec.
a Sulphur, Sublimed Flowers .. per ton	£18	..
a „ Lump .. „	£16	..
a Soda, Chlorate .. per lb.	4d.	1d. dec.
a „ Crystals .. per ton	£7	..
a Sodium Bichromate, casks .. per lb.	7d.	1½d. dec.
METALS, &c.		
p Babbitt's Metal Ingots .. per ton	£95 to £300	..
c Brass (rolled metal 2" to 12" basis) per lb.	11¼d.	¼d. dec.
c „ Tubes (solid drawn) .. „	1/1¾ to 1/2	..
c „ Wire, basis .. „	11¼d.	¼d. dec.
c Copper Tubes (solid drawn) .. „	1/9½	..
c „ Bars (best selected) .. per ton	£113	£4 dec.
c „ Sheet .. .. „	£113	£4 dec.
c „ Rod .. .. „	£113	£4 dec.
d „ (Electrolytic) Bars .. „	£77 10s.	30/- inc.
d „ „ Sheets .. „	£145	..
d „ „ Wire Rods .. „	£93 10s.	30/- inc.
d „ „ H.C. Wire .. per lb.	11¼d.	¼d. inc.
f Ebonite Rod .. .. „	3/6	..
f „ Sheet .. .. „	3/-	..
n German Silver Wire .. .. „	2/9	..
h Gutta-percha, fine .. .. „	13/6	..
h India-rubber, Para fine .. .. „	10¾d.	dec. ¼d. dec.
i Iron Pig (Cleveland Warrants) .. per ton	Nom.	..
l „ Wire, galv. No. 8, P.O. qual. „	£35	£5 dec.
g Lead, English Pig .. .. .. „	£24 10s.	25/- inc.
g Mercury .. .. .. per bot.	£10 15 to £11	..
e Mica (in original cases) small .. per lb.	4d. to 4/-	..
e „ „ „ medium .. „	5/- to 10/-	..
e „ „ „ large .. „	12/6 to 25/- & up	..
p Phosphor Bronze, plain castings .. „	1/4 to 1/9	..
p „ „ rolled bars and rods „	2/1 to 2/6	..
p „ „ rolled strip & sheet „	2/2 to 2/7	..
d Silicium Bronze Wire .. .. per lb.	1/4	..
r Steel, Magnet, in bars .. .. „	1/8	..
n Tin, Block (English) .. .. per ton	£165 10s. to £166	..
n „ Wire, Nos. 1 to 16 .. .. per lb.	4/- [10s.	..
p White Anti-friction Metals .. per ton	£78 to £300	..

Quotations supplied by—

a G. Boor & Co.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
p ——
r W. F. Dennis & Co.

Rangoon Electric Tramway & Supply Co., Ltd.—The annual general meeting was held in Rangoon on May 18th. Mr. R. S. Giles (chairman), who presided, said that the capital of the company remained the same. During the year £8,039 had been set aside for the redemption of debentures, in addition to a previous amount of £71,919. The total debentures outstanding had a value of £240,754. By transferring the company's offices from London to Rangoon taxes to the amount of £10,000 had been avoided, equivalent to a dividend of 5½ per cent. on the present ordinary capital. The passenger traffic on the tramways showed an increase of two million; this necessitated the purchase of 20 new cars and probably further additions would have to be made. The electricity supply business had also improved, and to effect the necessary improvements an increase of capital was under consideration.

Major & Co., Ltd.—Mr. J. L. Major, presiding at the annual meeting held on June 30th, said that there had been considerable expenditure upon improvement and enlargement, but, owing to the depressed state of trade, these had not shown the benefit expected from them. They had not escaped the general break in prices which took place, in their case, at the beginning of the present year. During the coal stoppage considerable quantities of fuel oil had been sold and also used by themselves. The most successful of the subsidiary companies had been Tarslag, Ltd., which was doing a very much increased business. The statement made last year that the earnings of the subsidiary companies would be sufficient to pay the interest on the preference shares would be more than justified.

Cape Asbestos Co., Ltd.—A dividend of 10 per cent. per annum, less tax, on the ordinary shares (including 3¾ per cent. already paid) is recommended; carry forward £9,136.

Dublin United Tramways Co., Ltd.—Interim dividends of 6 per cent. per annum, less tax, on the preference, and 3 per cent. per annum, less tax, on the ordinary for the past half-year.

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(*Continued from page 44.*)

The Economic Limits of Distribution from Coal-fired Stations.

By W. B. WOODHOUSE. (*Abstract.*)

THE solutions of the problem of supplying an area which extends beyond the economical limits of the distribution pressure in use are to supply it from: (1) One generating station by increasing the output to meet the demands and adding to the original distribution mains a higher pressure system or systems feeding into the general distribution system at a number of points [the general distribution system may or may not be subdivided into independent sections], or from two or more generating stations: (2) each feeding a part of the area independently of the others; (3) interconnected by a system of h.p. mains with or without intermediate feeding points.

Within certain limits the first solution is the most economical.

1. *Economy of Capital.*—The total cost of a generating station increases less rapidly than the rated output of the plant installed, particularly so in the case of buildings, auxiliary machinery, and steam turbo-alternators. The reduction of the capital cost of a turbo-alternator is a function of the speed and output, and puts at present an approximate limit of 25,000 kW to a single-cylinder machine, and 50,000 kW to a two-cylinder machine.

A large number of machines for the same total output will cost more; a smaller number, to give the same security, must be of a greater total rated output. If each turbo-alternator has an overload capacity of 25 per cent., and two sets are regarded as essential spares, then the economical subdivision is into ten sets. This particular consideration is modified by the relatively high steam consumption of smaller turbines which, in a station of, say, 30,000 kW, would reduce the economical number to seven. Interconnection of stations also affects the question. A further advantage of a large station is due to the diversity of demand arising from supply over a wide area which may have the effect, as between a station of 100,000 kW and one of 500,000 kW, of reducing the station demand by some 10 per cent., and the capital expenditure accordingly.

2. *Economy of Coal.*—The increase of efficiency as between turbines of 1,000 and 25,000 kW under similar steam conditions represents a saving of some 25 per cent. of the coal consumption. The diversity of demand improves the load factor and still further reduces the coal consumption. The economies made possible in a large station represent a further saving, but as between a 150,000 and a 500,000-kW station the amount is not great.

3. *Economies of Wages and Other Expenses.*—These represent a saving on only a small part of the total costs, and are relatively less important.

Total Saving.—It is with hesitation that one submits a general figure of the savings to be made on these accounts; however, the relative cost per kW-year varies somewhat as follows: 500,000 kW 100 per cent., 250,000 kW 114 per cent., 150,000 kW 122 per cent., and 50,000 kW 173 per cent.

Cost of Distribution.—Against these economies the extra costs of distribution over the wider area must be set. The requirements of a constant-pressure supply limit the radius of distribution at any particular pressure. If (as is usually the case) the pressure of utilisation and of detail distribution is fixed, then, to supply a wider area, a second system of higher-pressure mains becomes necessary, from which the secondary system is supplied at a number of points. This involves capital expenditure on which the annual charges must be met. The new system of mains and transformers also involves energy losses in iron, copper, and dielectric, and the annual cost of these must be added to the capital charges on distribution. However, the addition of the higher pressure system, by permitting the subdivision of the general distribution system, will allow a greater load to be carried on this latter system without further capital expenditure, or alternatively will effect a reduction of energy losses with the same load. In either case this saving must be taken into account. The economical area of distribution is a function of the load factor of the system, and other conditions which make a comparison between different areas a matter of great difficulty. If it be assumed that such an area has a density of load of from 500 to 2,000 kW per sq. mile, a pressure of 10,000 volts has been fully demonstrated by practical experience as suitable for general distribution. The economical area for such a pressure of distribution is approximately 150 sq. miles from which a station demand of, say, 137,500 kW may be expected to arise. As an indication of the magnitude of the various charges a comparison may be made for the hypothetical case of an area 15 miles square with a uniformly distributed load, and the comparison is made for a total area four times as great.

Case 1.—Extension of supply to the larger area from one central station involves the introduction of a higher pressure; if underground cables are used a comparison may be made between pressures of 33,000 and 66,000 volts. The use of overhead lines would lead unquestionably to the use of the higher of these pressures. The costs of these systems are indicated in Tables I, II, and III, and the annual cost of a kilowatt-year (60 per cent. load factor) at the busbars of a 500,000-kW station may be taken as £8 with coal at 20s. a ton.

TABLE I.—UNDERGROUND CABLES AT MAXIMUM RATINGS.

Cost per kVA Mile.

Pressure.	Cost per mile.	Rating.	Cost per kVA mile.
11 kV.	£14,000	18,300 kVA	£0.765
33 kV	£18,100	48,600 kVA	£0.373
66 kV	£23,000	78,800 kVA	£0.292

TABLE II.—UNDERGROUND CABLES.

Annual Cost of Capital Charges and Energy Losses per kVA Mile.

Pressure.	Rating.	Capital charges.	Energy losses.	Total.
11 kV	18,300	£0.095	£0.085	£0.18
33 kV	88,600	£0.047	£0.028	£0.075
66 kV	78,800	£0.036	£0.017	£0.053

Capital charges, 12½ per cent.
Energy losses, at 60 per cent. load factor, 0.5d. per unit.

TABLE III.—TRANSFORMERS AND SWITCHGEAR.

Annual Cost per kVA Double Transformation.

			Annual Cost.	
Pressure.	Rating.	Capital.	Energy.	Total.
33 kV	48,600	£0.264	£0.183	£0.447
66 kV	78,800	£0.299	£0.195	£0.494

Capital charges, 12½ per cent.
Energy losses, at 60 per cent. load factor, 0.5d. per unit.

Case 2.—The subdivision results in the loss of the benefit of diversity, in the increase of the cost of the stations, and in a poorer load factor. On the other hand, the expenditure on higher-pressure mains and transformers is altogether avoided.

Case 3.—The comparison here made is between equal stations of equal efficiency, one at each of the four corners of the area. Where an existing system is added to, the older stations are likely to be the less efficient, and it will prove economical to deal with the basis load (high load factor) from the new stations and the peak load from the old. Considerable economies of station operation may be gained by interconnection and for the development of a large area, whether the stations be of the same class or of different classes (peak and base load stations), practical conditions will compel the establishment of more than one station, and that the stations will be interconnected. The comparative costs are tabulated below.

COMPARISON OF ANNUAL COSTS OF ALTERNATIVE SCHEMES OF SUPPLY.

Case		1	2	3
Generating stations:—				
Number of stations		1	4	4
Total demand	kW	500,000	550,000	525,000
Mains and transformers:				
Pressure	volts	33,000	—	33,000
Route miles		42.4	—	60
Kilowatt miles		5,250,000	—	1,560,000
Annual costs per kW year:				
At stations	£	8.00	11	10.2
Distribution		1.23	—	0.24
Totals		9.23	11	10.44

For the area considered one large station shows an advantage over four. If for the same total load the area is increased and with it the distance between stations, an increase of transmission pressure will become necessary; this will introduce also intermediate feeding points whose effect on the cost of the 10,000-volt distribution complicates the comparison.

Broadly speaking, however, the comparison shows equality of cost between Cases 1 and 3 when the distance between stations is approximately 30 miles.

Low-voltage Overhead Distribution.

By B. WELBOURN. (*Abstract.*)

The distribution of electrical energy by bare overhead conductors has made slow progress in this country, two of the oldest and most important schemes being those of Ebbw Vale and Ystradgynlais in South Wales.

The B.E.S.A. has recently issued a specification for creosoted wood poles, and has in hand the preparation of specifications for telegraph and telephone line materials. The specifications which deal with insulators and pole fittings will be particularly useful for light power work, while the elaborate specification for different types of tubular light steel poles may be helpful in some directions. The B.E.S.A. also has in preparation specifications for copper and aluminium conductors and steel strand, but their completion is dependent on the results of extensive tests which are being made at the N.P.L. for the B.E.A.I.R.A.

Overhead lines are required to comply with "Regulations prescribed by the Board of Trade under Section IV of the Electric Lighting Act, 1888," (now administered by the Electricity Commissioners and under revision with the assistance of an *ad hoc* committee appointed by the I.E.E.). The exist-

ing regulations prescribe factors of safety which are highly controversial, and seldom observed.

For lines which give a supply to consumers at pressures above 250 volts, the regulations require that a continuous earth wire should be provided, that all metal work on each pole should be connected to it, and that it should be definitely "earthed" at every fifth pole. Nothing is said about earthing at pressures below 250 volts, and the author is decidedly of opinion that the fittings on each pole should not be "earthed" by a single wire coiled into a flat spiral beneath the lower end of the pole. There are various objections to it, the chief one being that the surrounding ground may not in all cases provide an efficient "earth."

The question of distribution by overhead wires *versus* underground cables is a controversial one, and cases may sometimes be settled by first-cost considerations, but, fortunately, æsthetic and maintenance conditions are sometimes given their full value—especially in garden city schemes. In one such scheme the total first cost of the overhead distribution, including 108 public lighting fittings, was £6,800, whereas the estimate for a high-class scheme using cables throughout was only some 20 per cent. higher. Allowing for the longer life and lower maintenance charges on cables, it is very doubtful whether there was any real saving by using overhead wires in this case.

Overhead distribution has a special field of its own in the development stage of the electricity supply industry in the United Kingdom—particularly in rural areas and in works and colliery distribution. The standard of work and appearance, as well as of continuity of supply, are much higher in this than in many other countries, and the author believes that ultimately the distribution in all our towns, garden cities, and large villages will be done by underground cables. The basis for this belief partly lies in the growing practice of the General Post Office in replacing overhead wires by cables even in country villages.

Discussion.

The papers by Messrs. Woodhouse and Welbourn were discussed together on the second day of the Conference, when Mr. Roger T. Smith presided over Section VII.

The Chairman, in opening the discussion, expressed the opinion that the last paragraph of Mr. Woodhouse's paper which stated: the "comparison shows equality of cost between cases 1 and 2, when the distance between stations is approximately 30 miles," was of great importance to railway men. It might be more economical for a railway company to erect a generating station of its own (even if it had only a capacity of 6,000 kW) if by so doing it could save 30 miles of transmission. The Electricity (Supply) Act, 1919, seemed to indicate that the railway companies should purchase electricity in the cheapest market, and they had the power to build their own generating stations. Regarding Mr. Welbourn's paper and the transmission of electricity by overhead *versus* underground lines, that was not purely a problem of economics from the railway point of view, because considerations of greater convenience and added safety might outweigh those of an economical nature.

Mr. A. Paignton thought that the new proposals now under consideration, if carried into effect, should make overhead transmission popular in this country. A seven-strand aluminium conductor, the centre strand being of steel, had advantages over copper for small conductors. In connection with the calculation of safety factors, the proposed ice load which it was suggested should be applied was good, but it should be remembered that the same factors of safety could not be applied to lines in exposed and sheltered positions.

Mr. B. Welbourn explained that the Electricity Commissioners had not yet accepted new factors of safety which had been suggested for h.p. lines. It was his opinion that l.p. distribution by overhead lines had a definite place to fill in the future, and many designers were only waiting for new rules and regulations to be issued before they proceeded to work on up-to-date lines. There was much to be said for the method of connecting the house service to the overhead pole line by means of a length of underground cable, and in that connection the subject of disturbance by lightning was an important one. Lightning surges had been known to reach a house circuit even through an underground cable system.

Mr. G. V. Twiss said that if Mr. Welbourn thought that overhead lines in sheltered positions should be erected in the same way that Post Office lines were, it should be realised that if a P.O. line came down, there was no danger to the public. Moreover, it would be useless to attempt to use telegraph insulators for l.p. power distribution. The reduction of the ice and wind loads on lines in sheltered positions would reduce the sag of large conductors, but would increase that of smaller ones.

Mr. S. G. Leech pointed out that larger wire than No. 3 or 4 could not be used if appearances were considered, because it was liable to kink if it was not stranded. "Weather proofing" the wire was of little use, and would not add one year to the life of the conductor. No one knew how the figure of 23 ft. for the allowable distance above ground of overhead conductors had been arrived at, and probably 17 or 18 ft. would be all that was necessary. He had found the G.P.O. most reasonable, and it had in some cases consented to insulate its wires with P.B.J. compound, which was the best way of overcoming the difficulty. There was probably a saving of between 40 and 50 per cent. to be made by the use of overhead distribution for public lighting and similar work, and he, therefore, differed from the author's conclusions. The only way to supply rural districts economically was by the use of overhead distribution, but he pointed out that P.O. experience showed that certain belts of the country were devastated once every ten years, and provision for rebuilding certain lines periodically would have to be made.

Mr. B. Bartholomew denied the statement that had been made to the effect that the P.O. carried out its work without regard to its cost. Nowhere was closer consideration given to the financial aspect of a job than in the Post Office. He pointed out that authorised and unauthorised suppliers of electricity did not have to comply with the same clauses of the Electric Lighting Acts, and also that towns and such like places could not be regarded as sheltered positions. The greatest risk of danger to the public from falling lines was in or near towns, &c.; the regulations were framed solely for the safety of the public—they were not in any way intended to be a specification for a good way of doing the job, and therefore the subject of sheltered positions should not be laboured too much. Some of the worst breakdowns had occurred at sheltered positions. The P.O. rules allowed several alternative methods of protecting its lines, for instance, the use of an earthed neutral as a guard wire. With regard to lightning, the author was perhaps an alarmist. If a conductor was struck directly it disappeared entirely and secondary effects due to discharges elsewhere could be satisfactorily dealt with by a gap between two carbon plates, one of which was earthed. He knew of no record of a building being damaged by P.O. lines being struck, and explained that the P.O. use of underground cable was not determined by any particular storm.

Mr. A. H. Preece was of the opinion that it was all a matter of economics, and that it was impossible to do overhead work now because of the cost of poles. Regarding Mr. Woodhouse's suggested 500,000-kW station, it would be extremely difficult to secure a suitable site for a station of such a capacity in this country. It would require 10,000 cu. ft. of water per minute which quantity could only be obtained at the coast. Moreover, it would use something like 5,000 tons of coal per day, and it would be necessary to hold two or three months' stock in hand so that the arrangements for handling such quantities of fuel would be very difficult, and it would be hard to justify the enormous expenditure that would be involved. A load factor of 60 per cent. could not be attained, and therefore the author's assumed figures were false ones. The diversity factor would only be slightly improved if the stations were to be combined—it all looked very nice on paper, but would not work in practice.

Mr. Ll. B. Atkinson agreed in part with the previous speaker's remarks regarding Mr. Woodhouse's paper; the only way to discuss it was to challenge the author's assumptions. Regarding Mr. Welbourn's paper, the speaker mentioned that the early distribution system on the Trafford Park estate was all overhead; it had now, however, all gone underground. Rural areas were the places for overhead distribution, if made at all, and when they put transformers on the consumers' premises they would at last begin to use higher voltages. In Holland, where a considerable amount of overhead line was in use, they experienced no more difficulty with 10,000 than with 500 volts. Concerning factors of safety, ice and wind allowances were really beside the point, the figures met with in practice were very much greater than anything allowed for in calculations. They must make up their minds that overhead lines would come down occasionally, the real trouble was that they were much more particular about continuity of supply in this than in other countries. It was a fact that lightning could get into a house circuit, and with reference to cost of poles, the speaker mentioned that cables now cost double their pre-war price, and road work, excavation, &c., from five to six times as much. He saw very little use for "weather-proof" wire.

Mr. W. A. Turnbull favoured h.p. a.c. underground distribution with transformers provided that the cables were made large enough initially for meeting future needs. In housing schemes the cables should be laid early while the ground was soft and before it was necessary to reinstate the surface.

Mr. MacEwan drew attention to the importance of the possibility of an insulated wire spreading fire in a rural area. It was a fact that a man could not run as fast as a flame would travel along the wire.

Mr. A. S. Barnard thought that the possibility of malicious damage being done to transmission lines should be realised and allowed for.

Mr. A. H. Pearce, speaking a second time, explained that a good many laymen liked to see something round the wire, and in some cases they had to comply with the wish (*i.e.*, in South America). In New Zealand a good deal of such wire was used, and he was told that the American cotton-covered and compounded wire lasted for ten years, whereas the English make only lasted half as long; it deteriorated because of the alternate wetting and drying.

Mr. G. V. Twiss also spoke a second time, pointing out that the failure of the American lines was due to the deterioration of the porcelain insulators. British porcelain did not deteriorate. The ice coating allowance was a logical method of calculating the stresses.

Mr. MATHEWS spoke in favour of American insulators.

Mr. B. WELBOURN, in reply to the discussion, said that "weather proofing" of wire was an abomination; it was no protection, and added nothing to the safety of men working on the line.

(To be continued.)

THE THERMAL EFFICIENCY OF HEAT POWER PLANT.

(Continued from page 45.)

ON Friday, July 1st, Dr. W. R. Ormandy, F.I.C., opened a discussion on "Liquid, Colloidal, and Powdered Fuels." He put the average calorific value of oil at 18,000 B.th.u. per lb., and that of coal at 12,000 (pre-war) and 10,000 B.th.u. (nowadays), but pointed out that the saving due to the use of oil was not confined to the difference in calorific values; the oil could be burnt with greater efficiency owing to the ease with which the best ratio of air to oil could be attained. Burning oil, an efficiency of 80 per cent. could be reached with a Lancashire boiler, while with bad coal the limit would be 60 or 65 per cent. Hence oil was the more economical up to the point where its price was from 1.75 to 2 times the price of coal. Purchasers should have their coal analysed to avoid paying for ash; in a particular case a customer who bought his coal by analysis received only 10 or 11 per cent. of ash, whilst others who did not follow this course received coal containing 22 per cent. of ash. With oil fuel, the cost of getting rid of clinkers was saved, a heavy item in London.

Generally in industry the boiler house was the place where the greatest economies could be made—far greater than in the engine room.

For marine use, oil had no rival. It should not, however, be burnt under boilers if it could be used in internal-combustion engines, the efficiency of the latter being far in advance of that of steam plant. The tendency in internal-combustion engine practice was to use oil with solid injection. Research should be directed towards using a wider range of oils; the Diesel engine was confined within narrow limits. The newer supplies of oil were of an asphaltic nature, and caused trouble in the engines; endeavours should be directed to making the engines suitable for fuels of this character, which carried the least proportion of valuable by-products, and were, therefore, the most suitable for combustion.

Powdered fuel was coming into extended use abroad; it had long been used here for cement kilns, as the best fuel for the purpose. Powdered coal was used a good deal in the United States, but Dr. Ormandy was loath to recommend its extended adoption here. It was doubtful whether it would pay to dry and grind the coal, in view of the high efficiency attained in burning fine coal on modern mechanical stokers. Powdered coal could certainly be burnt to better advantage than coal on a stoker, and its use might pay in special cases, but he doubted whether it would pay in ordinary cases. The cost of drying and grinding had been brought down by the use of ingenious machinery to 3s. or 3s. 6d. a ton, which was not much with coal at its present price, but they must consider the position that would be reached if coal was reduced to half the price ruling at present.

With regard to powdered lignite and peat, much time and money had been spent on the peat problem, and extended researches had been carried out in Germany, Norway, and Sweden. There was no way of drying it so good and cheap as by the use of mechanical diggers, macerating and drying in air to a moisture content of 27 per cent. Under cover it could be dried to 17 per cent., and powdered. Lignite was not so much used in the powdered form, but in Germany it had to be used, and had been found cheaper than coal.

Dr. Ormandy next dealt with powdered fuel mixed with oil. Coal was denser than oil, and tended to sink in it, the oil having a density of 0.93 to 0.98. The coal was ground fine to pass through a screen of 100 meshes to the inch—much of it passing through 180 mesh—at a cost of 2s. or 3s. per ton. Mixed with oil and used as a fluid, it did not appreciably increase the viscosity, and made the oil go further. With oil at £5 a ton and coal at 30s. to 35s., the mixture was cheaper than oil alone. While powdered coal by itself was not recommended, the use of the mixture with oil was worthy of serious consideration; the mixture behaved like oil, and it was said that the coal dust suspended in the oil tended to hold the more volatile constituents and reduce the flash point. Mexican fuel oil had a density of 0.95. When powdered coal was mixed with it in the proportion of 75 per cent., the coal tended to settle in a pasty cream, not like sand; the mixture could be agitated and the coal dust kept in suspension with very little expenditure of power. The distribution of oil was an important matter; it was in the hands of a small number of people. The apparatus used for the conveyance of fluids in wartime was available for use for this purpose. The coal could be ground and mixed with the oil after the latter was delivered. The author deprecated attempts to form a so-called "colloidal" mixture. A portion of the flue gases could be used to warm and agitate the mixture. One method of maintaining the dust in suspension was by giving the particles an electrical charge, so that they repelled one another; but the better plan was to depend on simple mechanical agitation.

In the discussion which followed, Sir HENRY FOWLER said he was surprised to hear that one could get from oil 1.75 to 2 times the value of coal; his own records suggested 1.5 to 1.75. The whole question was purely a financial one. The best burner was what was called the "Mexican trough" type, which was operated with steam at a pressure of 30 lb. per sq. in. He preferred to use oil with an efflux time of 400 at 60 deg. F. Much of the oil that was sold required preheating. He was not optimistic with regard to the use of oil on locomotives when the price of coal came down; a stoker must always be carried on a locomotive, so that no saving in labour could be made there by the use of oil. The difficulty attending the use of powdered coal was formerly the effect of the intense heat on the firebrick; had this been overcome? In the United States it was said that no such difficulty was met with, but he found that this was due to the use of a complicated system of replaceable brickwork. On the Rumanian railways lignite was used in conjunction with oil, but not mixed with it.

Mr. P. D. VERNON drew attention to a new system of powdering coal invented by Mr. Charles Blyth; the machine dried and pulverised the coal at one operation. It was of a rotary type, with two stages; in the first stage coal and hot air expanded outwards, drying and partially pulverising the coal; in the second stage the coal was drawn inwards, and pulverised, with the aid of a fan. Coal containing 25 per cent. ash and 20 per cent. moisture was put through the machine and came out in the form of a dry impalpable powder. A great saving was effected in the space occupied and power consumed; from 147 h.p. the power was reduced to 60 n.p., and two men did the work of five. The air discharged was free from dust, which was not the case with the old type of plant, of which the upkeep, moreover, was enormous. A further invention of Mr. Blyth's was described. During the shortage of coal it was desired to use a quantity of coal refuse, hardly black in colour, wet, and having a calorific value of only 7,000 B.th.u. per lb. This was put through the machine and blown into the cement kiln, but the flame was not hot enough. Mr. Blyth tried the effect of feeding in a small quantity of paraffin—only 0.07 per cent. of the weight of coal, with the result that the flame was completely changed. The powdered coal was here a vehicle for the oil, which was so small in quantity that the heat units which it represented and the cost of it were negligible. Apparently the oil enabled the "coal" dust to flash or burn in the kiln at an earlier stage. This device would enable them to burn rubbish that would otherwise be useless.

Mr. LAWRENCE asked whether the ash from finely powdered coal gave rise to trouble. At a works in Birmingham the fine ash went out of the chimney and settled on the neighbourhood, with the result that eventually they were compelled to shut down the plant.

The CHAIRMAN, Mr. Loughnan Pendred, gave some particulars of the work done in the United States, where powdered coal was used extensively. Grinding cost 1s. 0½d. a ton in 1918, and had to be done on the spot, as the dust was not transportable. The dust was also an extremely dangerous explosive, and could not be stored in large quantities. Powdered anthracite was useless owing to its lack of volatiles and had to be mixed with 40 per cent. of bituminous coal. The temperature attained in the combustion of coal dust was from 2,500 to 2,900 deg. F. An American correspondent informed him that the use of powdered fuel was going ahead very rapidly, and claimed that an efficiency of 85.6 per cent. had been attained with a large boiler by the Milwaukee Electrical Co., or 90.2 per cent. with the economiser, the CO_2 in the flue gases being 16 per cent.

Mr. GRIFFIN said that no liquid slag was formed when powdered coal was burnt in a properly designed combustion chamber. He thought the explosion scare was rather a bogy. It was quite easy to grind coal so that 85 per cent. of it would pass a 200-mesh screen, and it was no good going beyond that; the cost was 5s. to 5s. 6d. a ton, including interest and depreciation, and repairs. The ash gave trouble when much iron or lime was present, if the combustion chamber was unsuitable. Quite a large number of powdered coal installations were at work in England; an efficiency of 80 per cent. was attained during a 72-hour test, with coal which was useless for other purposes. The temperature conditions in the combustion chamber governed the formation of slag. Under proper conditions there was no smoke at all. The great advantage of powdered coal was the large surface of contact with air; the air supply could be reduced to the minimum. In a puddling furnace, the consumption of coal had been reduced from 25 to 12 cwt. per ton of iron. Powdered fuel could not be used in Lancashire boilers. Pit-mounds consisting of rubbish were now being burnt as powdered fuel.

Mr. R. W. BRUCE referred to the great future for powdered fuel, and asked what size the combustion chamber should be—an essential piece of information. The cost of grinding must be kept down.

Mr. ERITH, of the Underfeed Stoker Co., doubted whether powdered fuel would ever become of commercial value in England; the great cost of the plant killed it in competition with ordinary methods. The capital cost was 4 to 5 times as great, and a large space was required for the grinding and drying machines, while the running cost was also high. The total costs of capital, labour, and power for grinding and drying were nearer 5s. than 1s. or 2s. per ton. In a modern generating station they could obtain an average efficiency of 78 per

cent. if the plant were well cared for, and no great increase was likely with powdered fuel. There ought to be no difficulty in burning powdered anthracite if the furnace was suitably designed. This was a matter of enormous importance to South Wales, where vast quantities of fine anthracite, as well as of fine steam coal, were available.

Mr. FOSTER dealt with the size of the combustion chamber, and quoted records from the White-Foster boiler, which burned 114 lb. of coal per sq. ft. of grate per hour. He said there was no disadvantage in allowing the flame to impinge on the tubes.

Replying on the discussion, Dr. ORMANDY suggested that Sir Henry Fowler's figures for the relative value of coal and oil were lower because Sir Henry had included the cost of labour. In the case quoted by Mr. Vernon, the effect of the paraffin was probably due to its lower ignition point. The fine ash from powdered fuel was a real difficulty. He could not accept a boiler efficiency of 90 per cent.; 80.3 per cent. was very rarely attained. A mixture of coal dust and air was fearfully explosive. Powdered coal was useful in metallurgical industries, but he did not recommend it for boiler firing. There was no harm in letting the flame strike the tubes if the water was really pure. Anthracite dust was now in great demand.

(*To be continued.*)

THE LONDON FAIR AND MARKET.

ON July 4th, the London Fair and Market at the Agricultural Hall, Islington, was opened by Sir William Joynson-Hicks. As in the two preceding Fairs, electricity again does not play a very prominent part, although it may be said that the number of electrical exhibits is slightly larger this year.

Although the Fair is purely a trade show, it has been arranged with much taste, and is well worth a visit. The principle "lines" exhibited are hardware, toys, jewellery, stationery, and fancy goods, and these make an excellent display. The main feature of interest to the buyer of electrical goods is the stand held jointly by MESSRS. SIEMENS BROS. AND CO., LTD., and ENGLISH ELECTRIC & SIEMENS' SUPPLIES, LTD. This is a large display of electrical goods of many descriptions. On the "Siemens" side are numerous dry batteries, fluid cells, and accumulators, as well as many appliances for operation by these agents. Several cycle and motor-cycle lighting sets are shown which are marvels of compactness. In addition to these are samples of fuse units, distribution boards, pocket lamps, torches, and large incandescent lamps, vacuum and gasfilled. In the centre of the stand is a comprehensive display of ebonite and articles made of this substance. A new type of ebonite is shown which is variously coloured in a resemblance of marble, the colours being worked right into the material and not merely applied to the surface. The manufactured parts include telephone receivers and transmitters, as well as pipe stems and other non-electrical articles. On the "English Electric" side of the stand is a comprehensive range of domestic appliances. These were all manufactured in a Canadian works controlled by the company, and because of this the name "Canadian Beauty" has been applied to them. The predominant feature of all these appliances is their very high nickel finsh. All the usual small heating and cooking devices are on view. The grill is a strong but neat example of its class. It is fitted with two aluminium pans—deep and shallow—and a nickelled reflector plate which enhances its efficiency. The heating element, as in all the other appliances, is of pure nichrome wire wound on metal-bound mica. The plug contacts are well shielded, effectively guarding against shock to the user. Three "heats" are provided, and these are put into operation by inserting the plug on pairs of terminals in succession, one terminal for one heat being used for the next heat. The "Canadian Beauty" irons are made in various sizes, from the 3 lb. to a large tailor's iron; in this, again, as in all the articles, the contacts are heat-insulated and well guarded. Another useful appliance shown is a four-tier electric steamer, which only consumes 600 watts on full heat; 200 watts is sufficient to keep the water boiling once it has reached boiling point. A 1-kW "Britannia" fire is displayed; this is a very neat and convenient fire which weighs only 4 lb. Other appliances include boiling rings, coffee percolators, toasters, &c. A "Bee" vacuum cleaner is also shown. This is a very light machine with a high vacuum.

MESSRS. BENNETT BROS. have a brilliant display of artistic French glass-ware in the shape of bowls and lamp shades. A "relief" effect is obtained by burning off the surface of the glass in various designs by means of acid—the result is very beautiful. Many other small articles are shown, including a coloured glass scent diffuser, in which perfumes are evaporated through a perforated cap, by means of a small electric lamp. A cigar lighter shown is somewhat different to the usual type. It consists of a highly polished wooden case containing a well of porcelain in which are two small contacts. A brass top containing petrol has a small-bore stem, upon the end of which is a wad of asbestos wool in a brass collar. When this is plunged on to the contacts, the resultant spark ignites the petrol on the wool.

THE BRITISH CELLULOSE & CHEMICAL MANUFACTURING CO., LTD., has on view "Celastoid" non-inflammable celluloid in many shapes and forms. These include lighting bowls and lanterns, tumbler switches, bell pushes, &c., as well as such articles as table knives, brushes, and combs.

THE EXCELSIOR SHADE MANUFACTURING CO. has an excellent display of silk lamp shades and metal shade rings in many colours and designs.

Among a large number of toys exhibited by MESSRS. SUSSFELD FRERES, is a miniature workshop equipment, including a lathe, emery wheel, grindstone, and drilling machine driven through shafting by a little electric motor.

MESSRS. CHAS. BOYTON & SON, LTD., exhibit a large array of tumbler switches and metal stampings of all kinds. The "B.T.N." tumbler switch is of sound construction, and is finished in a number of styles, including brass, aluminium, bronze, nickel, and other finishes. A feature of these switches is that all pivots are screwed and not riveted.

ZONDERVAN WORKS, a French firm, exhibit a special type of builders' crane, which can be arranged for hand, petrol engine, or electrical operation. It has two jibs which may be used simultaneously, one lifting and the other lowering, or separately. This is effected by a common pinion between two wire drums, which may be moved to operate only one drum. The jib gearing is arranged to stop when a certain point is reached, thus preventing accidents due to an operator's inattention. Brick and block-making plant, for plain or decorative work, is also shown and operated, in addition to motor-driven stone and gravel crushers.

Another French firm, MESSRS. ROSSLIER & FOURNIER, show a novel electrical device in the form of a letter- or document-sealing appliance. This is an inverted conical brass container in which sealing wax is melted by a small heating element. The wax is applied through a small hole in the apex of the cone, which is opened and closed by a small metal plug operated by a thumb lever.

THE GEM LABOUR-SAVING DEVICE CO. displays a number of "Gem" vacuum cleaners and accessories. Electric vacuum cleaners also appear on the stands of THE DOMESTIC APPLIANCES CO. ("Simplex") and THE ELECTRIC APPLIANCES CO., LTD. ("Eureka").

MESSRS. O. F. AHLMANN have a display of glass ware, including lighting bowls, lamp shades, &c., and MESSRS. RICHES, GREEN & CO. exhibit a number of highly artistic lamp standards in carved wood and metal.

MESSRS. JARVIS, PERKIN & CO. show a number of their "Fonoto" telephone call recorders.

The London Fair and Market closes to-morrow (Saturday).

JOINT ELECTRICITY AUTHORITIES.

London and Home Counties Inquiry.

(*Continued from page* 71.)

On Wednesday, July 6th, Mr. BOWDEN, chief engineer to the Poplar electricity department, said that contrary to the views of the engineers of the technical scheme of the L.C.C., the Conference of Local Authorities and the nine companies' proposals, he held the opinion that in the case of East London the expenditure on a new capital station could be justified, and he did not recommend extending the existing stations beyond the plant already ordered for that purpose. He suggested that the whole area delimited by the Commissioners would be best dealt with by dividing it into, say, four districts, each with a separate District Committee with financial autonomy, but under the general control of a Joint Electricity Authority for the whole. His idea was that there should be an Advisory Committee of Engineers consisting of the chief engineers of the various electricity undertakings in the district, which should meet regularly and discuss the engineering policy, reporting its decisions to the District Committee, which, in turn, would make recommendations to the Joint Authority. In the event of differences of opinion, there would be an appeal to the Commissioners. It was not proposed that the District Committee or the Joint Authority should take over the power stations; they would remain in the hands of the existing authorities. His estimates had been based on including the railway and tramway load, which he thought was essential to obtaining the best results.

Sir JOHN SNELL said that having regard to the suggestion of Mr. Donald that the East London area might be worked by an independent committee within the ambit of a larger Joint Electricity Authority, for the reason that a better engineering scheme could be evolved for that district, the Commissioners thought that it would be better for Mr. Donald to confine his evidence to engineering, leaving the administrative side to be dealt with in argument.

Mr. BOWDEN, continuing his evidence, said that on the Dagenham site for the new power station there were already coal jetties, and that would save considerable capital expenditure. Moreover, it was obvious that the industrial development would take place in the Dagenham area. Dealing with working costs, he said there would be a considerable saving with regard to ash disposal, this saving being put at 5s. to 5s. 6d. a ton. He calculated that the ashes could be got rid

of for 6d. per ton on the Dagenham site, and taking 84,400 tons of ash when dealing with 600,000,000 kWh per annum, there would be an actual saving of £23,000 per annum, which represented a saving of from £250,000 to £300,000 capital expenditure on plant to deal with the ashes. That would more than offset the extra cost in transmission due to the extra distance of the site from London, which would be from £8,000 to £10,000. The land available for the site was anything up to 150 acres, and the owners had been approached, the price to be paid being under negotiation. Mentioning that Poplar supplied electricity more cheaply than any other part of London, Mr. Bowden said that last year the average price received was 1.66d. per kWh, and there was a net profit of £9,250. The nearest to that was 1.67d. per kWh at Stepney.

Passing on to what is being done now with regard to linking-up in the East London area, Mr. Bowden said that there was a saving of 800 tons per annum in each of the undertakings concerned, viz., Hackney, Poplar, Shoreditch and Stepney, and a saving of £1,500 per annum through one undertaking dealing with the light load for a certain period alternately. So far, however, full advantage had not been taken of the possibilities. A further trial extending the interconnection between these undertakings was to have been undertaken, but the coal strike intervened. By this extended trial it was hoped to save a further £500 per annum. In answer to Sir John Snell, Mr. BOWDEN said he did not think the full advantage could be obtained from interlinking until there was a central authority which should be able to direct operations and say what should be done. If the Committee of Engineers reported that a certain station should be shut down for a short period, or even altogether, he felt it would have more weight with the engineer of that station than would the opinion of one individual with autocratic powers to say what should be done. He did not think it would be necessary for the District Committee to have an engineer, at any rate, at the beginning.

Sir JOHN SNELL asked if engineers would be able to find time to attend to the work of such a committee, having regard to the increasing importance of the commercial side of the business, and the increasing call on the engineer's time in that respect.

Mr. BOWDEN agreed that the work of such a committee would at times be very heavy, but the engineers were now working on similar lines. If the proposition was put before the various undertakings from the business point of view, he believed they would all come in.

Sir JOHN SNELL said that it had taken eleven years to interconnect four stations, this interlinking having started in 1910. At this rate it would take until the third generation to get in the whole of the undertakings on the present basis.

Mr. BOWDEN said that was hardly a fair way to put it. Between 1910 and 1914 Poplar and Stepney were connected, and an agreement was entered into between them that neither would extend without consultation. As a result, Stepney put in new plant and Poplar refrained at first. Then Poplar put in two sets when it only wanted one, in order that Stepney should not be put to the expense of extending. Now Stepney was extending again. At first he did not propose that there should be an engineer to the District Committee, but later, when the East London scheme erected a generating station, then he would have a chief engineer to the District Committee.

Mr. HENDERSON, cross-examining for the L.C.C., put it that Mr. Bowden now abandoned the idea of being a separate area, and asked to be a sub-committee under the main autnority. Mr. BOWDEN agreed.

Mr. HENDERSON then put it that East London, having certain advantages, did not want to sacrifice anything for the benefit of the non-industrial area outside, and thus the supply in that non-industrial area could not be cheapened.

Mr. BOWDEN said that was largely the case, but the development of the non-industrial area would depend largely upon railway electrification, and there were other factors which might come in to cheapen the supply in the non-industrial areas. Witness added that the East London scheme had been devised as a municipal scheme as far as possible.

Mr. HENDERSON suggested that possibly the promoters would prefer to confine the scheme solely to the area north of the Thames, and that the addition of the other portion south of the Thames was really only camouflage.

Mr. BOWDEN said the area north of the Thames was the area selected by the Conference of Local Authorities when London was divided into areas before that idea was abandoned by the Conference, and he believed he could justify a scheme for that area apart from the southern part.

Dealing with the cost of ash disposal, Mr. BOWDEN said that this would be at the low figure of 6d. per ton, because the ashes would be used for spreading out on the site around the works for building up the level of the land. That would go on for a good many years.

In answer to Mr. Turner, who pointed out that the Joint Electricity Authority would have power, under the Conference scheme, to set up such a District Committee as was now suggested, Mr. BOWDEN said that would go a long way to meeting his case, but he wanted something more definite.

The effect of Mr. Turner's cross-examination was that all Poplar was asking to do could be done by the Conference scheme.

Mr. KENNEDY, for the companies, asked whether the station proposed at Dagenham was likely to be more economical than a station at Beckton.

Mr. BOWDEN said he had inspected that site, and did not consider it so good as Dagenham, and he believed electricity could be supplied more cheaply from Dagenham because of the physical disabilities of the footpath between the river and the site, which would necessitate putting the buildings further back, thus involving extra expense in pipes, &c.

Mr. MORSE put some questions, pointing out difficulties through including the City of London Co.'s Southwark area in the district delimited by the scheme, and Mr. BOWDEN, while quite willing to leave out all the companies included in the companies' scheme, said he would not compel any company remaining in the area to take a supply, but would deal with it on a business basis.

Answering Mr. Booth, Mr. BOWDEN said he contemplated supplying the whole of the area eventually from one or more capital stations, shutting down all the existing stations.

Asked if, on the assumption that the other authorities did not come in, he would advise his own authority to come into the larger scheme, Mr. BOWDEN said he would not take a dog-in-the-manger policy, and on the whole he felt he would have to come into the other scheme, but he hoped the Commissioners would give special consideration to the industrial area. So far as the control of the Joint Authority for the larger area was concerned, his intention was that it should only be over operation and not finance.

Discussing the erection of capital stations, Mr. BOWDEN said that the cost of plant was now 20 per cent. lower than last year, and cables were from 20 to 25 per cent. lower. He did not think prices would fall very much more during the next few years, and therefore there was no need for undue delay in erecting capital stations. He felt that the engineers who had drawn up the technical scheme for the L.C.C., companies, and Conference of Local Authorities, had displayed an excess of caution in dealing with this matter.

Sir JOHN SNELL put a number of questions tending to show that there was no substantial difference between the scheme on the engineering side and the engineering proposals for the other schemes, except as regarded the position of the generating station. Mr. BOWDEN agreed.

Sir JOHN SNELL, in his final questions, suggested that by breaking up the large area into a number of smaller ones would be reintroducing the difficulties already experienced by supply authorities through the existing small areas.

Mr. BOWDEN said it was all a question of getting the proper area, and he reminded Sir John that the companies' scheme took in a smaller area than that delimited provisionally by the Commissioners.

Mr. E. M. LACEY said that in 1918 he was instructed to prepare a report dealing with electricity supply in West Ham and Poplar, at the same time bearing in mind the supply in the area now called the East London area. In 1919 there was a conference of electricity authorities with the Commissioners, and at that conference it was understood that if any scheme was put forward dealing with a part of London on the engineering side, it must contain an administrative scheme for the whole area delimited.

Sir JOHN SNELL said his strong advice on that occasion was that all parties should endeavour to come to an agreement.

Mr. LACEY, continuing his evidence, said he was asked to prepare a scheme for the East of London, and in doing so he came to very much the same conclusions as the other engineers, taking London alone. Then he dealt with the East London area, he considered whether he could justify erecting a capital station earlier than would be the case with the larger area, and he came to the conclusion that he could, having regard to the demand and the price at which electricity was being supplied. He gave the figures of load factor, &c., given by Mr. Donald in his opening statement, and put it forward that when a capital station was erected the same advantages would accrue, the present advantage being that electricity was supplied in the East London area at 22 per cent. less than in the rest of London. He strongly advised against putting any new plant, other than that already ordered, in the existing stations, and said the capital station should be proceeded with so that it could be made use of in 1924 or 1925. To do what was proposed in the L.C.C. and other schemes, was to continue the present bad practice of adding to many small stations, and, moreover, it would be necessary eventually to centralise the supply. As to the railway load, he said his experience of adding a tramway load to a general supply was that the combined load factor was higher than either of the two individual load factors, and he anticipated that the same thing would be found to be the case with railways, and thus both parts of the supply would benefit. Railway electrification went on so gradually that the supply for it would be better dealt with as part and parcel of a general supply, and in that way, the railway companies would get electricity more cheaply than by putting up a separate power station.

Mr. LACEY, continuing his evidence on Thursday, July 7th, said that the figures of cost already given were per unit generated, but adding charges for working capital (not provided for in the other schemes) administrative charges, and interest and sinking fund, brought the total cost per unit generated in 1926 to 0.999d. per unit, and in 1931 to 0.912d. per unit. Thus the same disparity between the area chosen and the larger area which already existed, being an advantage of 22 per cent. in favour of the East London area, would continue

to exist if the East London area were developed on the lines laid down in the scheme.

Summing up the advantages of site in his scheme over the others, Mr. Lacey said that there was the constructional advantage of not having to construct coaling jetties—a similar advantage being claimed for the Beckton site at a saving of £300,000—and the land was very much cheaper, the bulk of it being marsh land. For the 50 acres available for buildings, &c., he had allowed £600 an acre, which, he thought, was reasonable, and for the marsh land on which the ashes would be dumped, he had allowed £100 an acre.

Cross-examined by Mr. Henderson, Mr. Lacey said the Advisory Committee of Engineers would only exist during the interim period of five or six years until the capital station was erected, and when that time arrived, a chief engineer would be appointed for the East London area, and it would be necessary for him to replace the Advisory Committee of Engineers. He might even be appointed before the capital station was built. When the undertaking had developed sufficiently for the capital station to be erected, he was inclined to the view that there should be one person in charge of the whole, with the necessary authority to see that his requirements were carried out.

Mr. Henderson wished to know to what extent Mr. Lacey proposed that the District Committee should be under the control of the Joint Authority for the larger area. As first put forward, the East London scheme was to have a separate Joint Authority for that district; now that had been abandoned, and a District Committee was asked for, with financial autonomy. In that way, it would be unfavourable to develop the whole of London on an economical basis, because the non-industrial areas would get no benefit from collaboration with the industrial areas.

Mr. Lacey said that in dealing with a large industrial area a difference of 0.1d. per unit was a very important matter, whereas in non-industrial areas, even 0.25d. per unit difference was not material. Therefore, if the linking-up, financially, of a non-industrial area with an industrial area resulted in an increase in price in the industrial area, it might make all the difference to the success or otherwise of industries in that area. During this cross-examination, a discrepancy was found in the figures of the estimates, but even so it was agreed that the total figure of cost of generation was less than that shown in the L.C.C. scheme. At the same time, other inconsistencies were found, and Sir John Snell requested that certain tables should be redrawn.

Answering Mr. Turner, for the Conference scheme, Mr. Lacey said he did not agree with preferential tariffs in particular districts under the ægis of a Joint Electricity Authority for the larger area.

Mr. Kennedy, for the nine companies, put some questions to show that in some parts of London the load factors were even better than in the East London area.

Mr. Lacey, replying to further questions, said he did not agree with the policy of the L.C.C. in proposing to extend the Stepney station to the fullest limit of its capacity. His opinion was that no other plant than that already authorised and in hand should be put in the existing stations.

Sir Harry Haward asked if the engineer of the Joint Electricity Authority for the whole area should have any control over the engineer of the District Committee.

Mr. Lacey thought not. The engineer of the District Committee should have complete control of that district as far as the executive work was concerned, but the District Committee would bring all matters before the engineer of the Joint Authority, which would decide whether it should act on the advice of the engineers of the District Committees.

Sir Harry Haward said this appeared likely to lead to a duplication of officers and duties, and not likely to lead to a reduction of the cost of electricity in the long run.

Mr. Lacey did not take that view. He had included £7,000 per annum as the administrative expenses of the District Committee during the interim period, including a small technical staff.

Sir Harry Haward then contrasted the periods adopted by Mr. Lacey in his estimates for the repayment of loans, as being too high compared with the periods usually allowed.

Mr. Booth asked what there would be left for the Joint Authority to do. Mr. Lacey said it would deal with broad questions of policy and finance.

Mr. Page drew attention to the fact that in his estimates Mr. Lacey had put down £20 per kW as the cost of the plant in the capital station by 1926 against £24 per kW in 1931.

Mr. Lacey said he had made that difference because by 1931 more buildings would be required, and the cost of these he estimated would more than offset the tendency for prices to fall.

During the afternoon Mr. Henderson, for the L.C.C., entered a protest against questions of administration under the Poplar scheme being left to counsel's speech, as suggested by the chairman yesterday. Such a procedure, he said, was hardly fair to the L.C.C. and others, who should have the opportunity of testing the relationship of the District Committee to the Joint Authority for the larger area, for instance, through a witness.

Sir John Snell said he thought the point was a good one, and it would be in Mr. Donald's own interest to put forward a witness to deal with this aspect of his case, seeing that the original proposal to constitute a Joint Electricity Authority for the area had given way to a proposal to form a District Committee. Questions were then put by Sir John Snell as to the ability or otherwise of engineers to design and carry out a scheme for such a large area as the one delimited by the Commissioners, and he quoted Chicago and the North-East Coast as examples of what he meant.

Mr. Lacey adhered to his view that it would be unwise to put the whole of the control under one man in such a large area.

Other questions put by Sir John Snell were directed to the point that a Committee of Engineers such as that suggested under this scheme would lead to great delay.

Mr. Lacey said the point was that having got a scheme for a definite area, it would be possible for the engineers to go ahead at once.

Sir John reminded Mr. Lacey that under the terms of the Electricity Supply Act, 1919, authorised istributors must be supplied at a price not exceeding that at which they could supply themselves at the present time. Therefore, he could not see why, if Poplar was merged in the larger scheme, the price it would have to pay for energy would be any higher than it now was.

Mr. P. J. Sutton, F.I.C.A., handed in an estimated balance sheet of the revenue of the proposed East London District Committee, showing details of the estimated costs of generation in 1925 and 1931, the total figures of which had already been given by Mr. Lacey.

Mr. Henderson, for the L.C.C., asked where the revenue for the District Committee was to come from under the scheme during the first period, until the capital station was erected. As it had been put forward the scheme was that the existing owners of the stations would continue in possession until their plants were closed down.

Mr. Sutton agreed that in these circumstances the District Committee would have no revenue.

Sir Harry Haward said that what he wanted to know with regard to the scheme, and at le ast one other, was what revenue the Joint Authority or District Committee would have until the capital stations were built. He hoped that that information would be forthcoming before the inquiry was concluded.

Mr. Donald said that he frankly stated that under his scheme there would be no revenue for the first five years, or until the capital station was in operation.

After a short discussion as to procedure, it was decided to adjourn until Tuesday, July 12th, the reason being that certain financial witnesses for the three previous schemes who have to be recalled would not be ready for the followng day, neither would it be convenient for Mr. Donald to call his witness on the administrative side of the scheme, whilst the railway companies, the next on the list, also were not ready.

At the opening of the inquiry on Tuesday, July 12th, Sir John Snell, speaking to Mr. Morse, said it would be advisable and useful if he could put in some evidence showing the growth of the load in the County of London and West Kent Companies' area, and the effect of the Barking station on the areas of the company inside London. Mr. Morse promised to consult with his clients on the matter.

Mr. Donald then handed in the resolution passed by the Poplar Borough Council authorising the submission of the East London scheme.

Sir John Snell then asked Mr. Donald to call his witness to deal with the administrative portion of the East London scheme.

Mr. Donald said the difficulty was that having been asked by the chairman to deal with that in argument, he had released the witness whom he intended to call, and could not get him back from the country, and he felt he had been prejudiced by the course the proceedings had taken. All he could do was to call a witness for the Poplar Borough Council, and do the best he could in the circumstances.

Mr. Tate, assistant manager of the Poplar Electricity Department, handed in a scheme for the formation of the District Committee on the lines of the proposals made by the Conference of Local Authorities at the time when it was proposed to divide London into four areas for the purpose of electricity supply. This statement differentiated between the executive functions of the Joint Authority and the District Committee. It was suggested that the Joint Authority should make such regulations as were necessary to bring about coordination of supply, such as provision of new generating station, laying mains, extending existing stations, shutting down stations, &c., the supervision of working arrangements between one District Committee and another, charges, &c. Each district would have its own capital stations and subsidiary stations, but each district would be connected up electrically, and it was over the arrangements for this that it was proposed the Joint Authority for the whole area should have control. On the other hand, the District Committee should have powers to appoint an Advisory Committee of Engineers consisting of the chief engineers of the undertakings in the district, which committee should carry out the same duties within the District as were to be carried out by the Joint Authority as between the various Districts. As to loans, it was suggested that the Joint Authority should raise them on behalf of the District Committee or Committees on the security of the rates of the whole area of the Joint Authority.

Sir Harry Haward said this would involve the Joint Electricity Authority in lending money to a Committee of itself.

Mr. Donald said it was done every day under the Education Act, the Education Committees having separate accounts. The Joint Authority could raise loans and place the proceeds at the disposal of the District Committees, as was done in the case of Education Committees. Where, however, the Joint Authority did not approve of certain proposals of a District Committee, and, on appeal to the Commissioners, the scheme was passed, then the loan should be raised by the District Committee on the security of the rates of the particular district. This, however, would be avoided if a Joint Committee was set up under Section 8 of the Electricity Act of 1909.

Mr. Cray Henderson, cross-examining for the L.C.C., was told by the witness that the administrative scheme had not been before the Poplar Borough Council, because there had not been time.

Witness agreed that in some degree this scheme would localise electricity supply, but it would be in areas large enough for economical distribution and for self-control, which was very different from the present state of affairs.

Mr. Turner put it that the District Committee would, under the scheme, have a power of appeal to the Commissioners against the Joint Electricity Authority of which it was a Committee. Witness agreed.

Mr. Donald, in re-examination, said all the difficulties suggested in the working of this proposal would also arise in connection with the Companies' scheme.

Sir Harry Haward said it was quite possible that any Joint Electricity Authority might decide to work the area by District Committees as suggested by Poplar, but he understood the East London scheme went further and asked for autonomous powers, at any rate financially.

Mr. Tate said that was so.

Sir Harry Haward: And have the credit of the central authority for raising money?

Mr. Tate said not necessarily, because he believed the East London area would be able to raise its own capital on satisfactory terms.

With the handing in of some revised tables of estimates in regard to the engineering aspects of the scheme, Mr. Donald closed his case.

Mr. Cray Henderson, referring to the Conference between the L.C.C., the Conference, and the Companies regarding the purchase of undertakings, said it had been found impossible to come to an agreement, as the local authorities desired certain terms with regard to acquisition of the Companies' undertakings, which the L.C.C. did not agree with, nor did the Companies.

Mr. Turner, for the Conference of Local Authorities, said that certain resolutions had been passed by the Executive of the Conference dealing with the question of purchase. The main point of these was that the Executive did not feel justified in considering the question of purchase coupled with an extension of the Companies' distributing powers, without consulting the whole of the members of the Conference.

Sir John Snell said it seemed that the main point in dispute was the point of the extension of the Companies' life as distributors.

Mr. Turner said if the difficulty of dealing with the acquisition of the Companies' apart from any extension of distributing rights could be got over, it would go a very long way towards agreement. It was intended to hold a full meeting of the Conference to consider the position, but the Executive Committee did not feel it could go further than it had in the resolutions that had been passed. All the proposals for extending the Companies' distributing rights had been brought up since the inquiry began, and he was not yet sure what attitude some of his local authorities might now wish to take with regard to it.

Sir John Snell said the Conference must be fully aware that there was no power to compel the Companies to come into any scheme for the re-organisation of electricity supply in the area, and could they expect the Companies, as it were, to give something for nothing?

Mr. Turner said that was hardly the view which the Conference Executive took. They felt that if the Companies got the cost of their stations less depreciation, and a guarantee of electricity at no higher price than that at present possible, then they had got sufficient consideration without any question of an extension of distributing powers.

Sir John Snell said that speaking on his own responsibility he sincerely hoped this opportunity for the L.C.C., the Companies, and the local authorities to come to an agreement would not be lost. As things stood, the L.C.C. could in 1928 give notice to acquire all the Companies' undertakings in London. The L.C.C. was willing to agree to an extension of the Companies' distributing powers, with a view to inducing the Companies to come into a scheme at once. If the Companies were purchased under the terms of the Act of 1888, the cost would be more than the terms now proposed by the nine companies, and could Mr. Turner suggest any means for consolidating the supply without the assent of the Companies? He imagined the answer was "No." [Mr. Turner agreed.] Therefore, if the Companies were willing to sell their stations or allow control practically at once and upon terms which were less than under the 1888 Act, could they expect them to do it without some *quid pro quo*?

The matter was left there for the moment.

Mr. Tylor then opened the case for the L.B. & S.C. Railway and the G.E. Railway.

(To be continued.)

The Sheffield Corporation's Scheme.

What follows is an abstract of the scheme that has been submitted to the Electricity Commissioners on behalf of the Corporation of the City of Sheffield (Mr. S. E. Fedden being the general manager and engineer of the electricity department) for the constitution of a Joint Electricity Authority for the North-East Midlands Electricity District.*

The scheme is divided into administrative, technical, and financial sections, and proposes that the Authority shall consist of 18 members, of whom 12 will be appointed by the City Council of Sheffield and the County Borough Council of Rotherham, and one each by the Borough Councils of Chesterfield and Doncaster, and the County Councils of the West Riding of Yorkshire, Derbyshire, Nottinghamshire and Lindsey.

The Authority may give notice to the Yorkshire Electric Power Co. requiring it to sell to the Authority so much of its undertaking as is within the district upon the terms set out in Section 2 of the Electric Lighting Act, 1888.

Regarding the second or technical part of the scheme, it is proposed in the first instance to interlink the generating stations at Neepsend, Blackburn Meadows, and Rotherham. Later, as required, links will be carried out as follows: (1) Rotherham, Mexborough, Doncaster. (2) From Neepsend to Dronfield, Sheepbridge, Chesterfield, Clay Cross, Staveley, Barlborough, and Eckington. (3) Blackburn Meadows and/or Rotherham to Ecclesfield and Chapeltown. (4) Blackburn Meadows and/or Rotherham to Rotherham Main Colliery, Treeton, Waleswood, Kiveton Park, Shireoaks, and Worksop. (5) Rotherham to Greasborough, Kilnhurst, Rawmarsh, and Wath-on-Dearne. (6) Rotherham to Silverwood, Thurcroft, Dinnington, and Maltby. (7) Mexborough to Yorkshire Main Colliery and Doncaster or *vice versa*.

The system to be adopted will be three-phase alternating current, 50 periods. The main transmission pressure will be 11,400 volts, or higher if necessary, and will be stepped up to these pressures from the existing generating pressure, which in the majority of the stations is either 11,400 or 6,600 volts. The suggested transmission lines will be 14 in number, of which six will consist of single cables and seven of duplicate cables, while that from the Doncaster new station to Kirksandall will be an overhead line. All the lines will be at a pressure of 11,400 volts, except that from Rotherham to Silverwood and beyond, which will be at 6,600 volts; 3-core cable of 0.25 sq. in. section will be used throughout. Provision will require to be made for one 10,000-kW transformer with switchgear at the Rotherham station, and the following extensions of plant are in course of construction or authorised to be proceeded with: Chesterfield, 3,000 kW at 6,600 volts; Doncaster, 6,000 kW at 3,000 volts; Rotherham, 30,000 kW at 6,600 volts; Sheffield, 53,500 kW at 11,400 volts.

The maximum loads estimated for the first five years for the main generating stations are as follows: Buxton, 400 kW; Chesterfield, 5,344 kW; Doncaster, 6,000 kW; Mexborough, 1,500 kW; Rotherham, 36,000 kW; Sheffield, 100,000 kW; Worksop, 650 kW; total, 149,894, say, 150,000 kW.

The additional demand anticipated from existing installations of private plant is 15,000 kW, and that from the coal owners is 5,000 kW. The allowance for spares is 57,000 kW, and the existing plant installed or authorised amounts to 210,610 kW, which, less the Sheaf Street station that is to be discarded, leaves a balance of further plant required by the end of the first period of, say, 20,000 kW.

The estimated maximum demand for second period of development is: Maximum demand at end of first period, 170,000 kW; 10,000 kW per annum of local loads, 50,000 kW; railways, 40,000 kW; coalowners, 20,000 kW; allowance for spare, 93,000 kW.

The existing plant at end of first period is 227,000 kW, leaving balance of plant required by end of the second period of 146,000 kW.

The maximum loads that can be provided for during the first five years by the undertakings with existing plant and extensions already sanctioned, allowing 25 per cent. for spare, will be 155,000 kW, which shows a difference of 15,000 kW, plus its proportion of spare, making 20,000 kW additional plant required during the first five years, to be installed as determined. During the second period of development it is anticipated that the maximum loads on the generating stations of the authorised undertakers will have increased to 280,000 kW, and with a reasonable allowance for spares, a total maximum plant capacity of 373,000 kW must be provided, to meet which the aggregate plant installed will amount to 227,000 kW, leaving a balance of excess load over plant capacity of 146,000 kW.

The additional plant required will be provided as follows: At Blackburn Meadows, 30,000 kW; at Rotherham, 30,000 kW; and at the new stations at Doncaster and Mexborough, 90,000 kW, increasing later to 120,000 kW.

As the plant at the following stations becomes obsolete it will be discarded, provided an alternative and cheaper supply is available:—The Sheaf Street and Kelham Island stations of the Sheffield undertaking and the existing stations at Chesterfield, Doncaster, Worksop, Mexborough, and the Rotherham No. 1 station. The scheme will include provision for supplying the railways in the area with an extra high-pressure supply into sub-stations at convenient centres.

* Elec. Rev., Oct. 1st, 1920, p. 434.

NEW PATENTS APPLIED FOR, 1921.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C. 1.

17,200. "Electrical transmitter microphones." B. A. Pilkington. June 23rd.
17,234. "Electric signalling." B. Davies and Eastern Telegraph Co., Ltd. June 23rd.
17,236. "Radio telegraphy and telephony." W. G. Gold. June 23rd.
17,240. "Mercury-vapour pumps for high vacua." Akt.-Ges. Brown, Boveri et Cie. June 23rd. (Switzerland, July 17th, 1920.)
17,246. "Pressure responsive circuit controllers." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co.). June 23rd.
17,252. "Continuous-action synchroniser." R. Esnault-Pelterie. June 23rd. (France, August 10th, 1920.)
17,255. "Control of electrically-propelled vehicles." Electro-Mechanical Brake Co., Ltd., and M. J. Pattison. June 23rd.
17,258. "Motors for high-frequency electro-magnetic current or electro-magnetic waves." H. Plauson. June 23rd. (Germany, June 23rd, 1920.)
17,265. "Electric-cable connections." H. F. Shanahan. June 24th.
17,273. "Speed control of alternating-current electric motors." R. E. Keelan and A. H. Railing. June 24th.
17,280. "Electro-plated vessels." S. Gladwin. June 24th.
17,289. "Sparking plugs." W. P. Thompson (Taaffe). June 24th.
17,297. "Mounting electric motor for providing power for domestic uses." P. Berard. June 24th. (France, June 26th, 1920.)
17,299. "Supports for electric lamp holders." W. Barnett, B.S.T. Electric Fittings Co., F. Saunders and P. J. Thompson. June 24th.
17,300. "Electric switches." J. B. Tucker. June 24th.
17,307. "Sparking plugs." J. Richardson. June 24th.
17,324. "Electric furnaces." L. J. Hancock and T. R. Hancock. June 24th.
17,326. "Influence electrical machines." L. Vogel. June 24th. (Switzerland, July 2nd, 1920.)
17,331. "Safety apparatus for automatic disconnection of faulty electric circuit sections." M. Hochstadter. June 24th.
17,332. "Self-induction coil." Felten & Guilleaume Carlswerk Akt.-Ges. June 24th. (Germany, June 24th, 1920.)
17,336. "Wireless transmission of electrical energy." E. Almeide y Salaza. June 24th.
17,337. "Recording devices." British Thomson-Houston Co., Ltd. June 24th. (United States, June 24th, 1920.)
17,338. "Electric switches." British Thomson-Houston Co., Ltd., and General Electric Co. June 24th.
17,351. "Removable device for establishing electrical connection between coupling parts." A. Courtois and J. Roullier. June 24th. (France, April 1st.)
17,361. "Preparing and transmitting telegraphic, &c., messages." A. C. Baronio. June 24th.
17,365. "Electric conductors." W. P. Granville. June 24th.
17,366. "Wireless receivers." R. B. Ransford (Soc. Française Radio-Electrique). June 24th.
17,367. "Electric relays." R. B. Ransford (Soc. Française Radio-Electrique). June 24th.
17,396. "Commutators or distributors for electric ignition system." F. E. W. Baker. June 25th.
17,399. "Electro-magnetic wave-receiving arrangement." Soc. Française Radio-Electrique. June 25th. (France, November 3rd, 1916.)
17,405. "Day and night electric way indicators." W. T. Hughes and L. Perks. June 25th.
17,413. "Brush holders for dynamo-electric machines." W. H. F. Higgs. June 25th.
17,449. "Electric lamp holders." H. B. Prentice. June 27th.
17,457. "Electric transmitter microphones." E. D. Young. June 27th.
17,458. "Finger stall device of electric horn control for automobiles." W. J. Campbell. June 27th.
17,461. "Dynamo cut-out." J. B. Bignamy. June 27th.
17,463. "Globe-holders for electric lights." J. C. Whitlock. June 27th.
17,465. "Generator." D. Suchostawer. June 27th.
17,493. "Adjustable device for conveying electric current, fluids, &c." J. W. Harris and E. J. Shave. June 27th.
17,495. "Flywheel dynamotors for internal-combustion engines." R. L. Aspden. June 27th.
17,506. "Arrangement of electrodes for fusing electrolytic apparatus." T. Kolkin. June 27th.
17,513. "High-frequency electrical apparatus." R. P. Fuge. June 27th.
17,518. "Control system for motors." W. J. Mellersh-Jackson (Soc. des Etablissements Gaumont). June 27th.
17,525. "Electric switches." G. V. Twiss. June 27th.
17,536. "Electric heaters." F. F. D. Davidson and L. M. Waterhouse. June 28th.
17,567. "Electrical transmitter microphones." B. A. Pilkington. June 28th.
17,576. "Telegraphic apparatus for transmitting messages, drawings, &c." P. M. Macintyre. June 28th.
17,583. "Electric switches." A. P. Lundberg, G. C. Lundberg, P. A. Lundberg, and G. Pegg. June 28th.
17,585. "Electro magnets." J. Neale and J. A. Manners Smith. June 28th.
17,586. "Audible signalling devices." K. O. Leon. June 28th.
17,594. "Electric rotating furnaces." C. E. Cornelius. June 28th.
17,597. "Electric measuring and indicating instruments." R. H. Barbour and A. J. Martin. June 28th.
17,600. "Magnetic locks for electric lamps for mines, &c." F. J. Turquand. June 28th.
17,603. "Electric motors." Igranic Electric Co., Ltd. (Cutler-Hammer Manufacturing Co). June 28th.
17,607. "Reflecting devices." British Thomson-Houston Co., Ltd., and W. Millner. June 28th.
17,608. "Electric switch boxes." British Thomson-Houston Co., Ltd. (General Electric Co.). June 28th.
17,615. "Electric protective systems." Metropolitan-Vickers Electrical Co., Ltd. June 28th. (U.S.A., October 9th, 1920.)
17,618. "Electric bell." E. Magerle and J. Ges. Steiner. June 28th. (Austria, June 28th, 1920.)
17,621. "Electrically braking motor vehicles." P. V. Powell and P. E. Smith. June 28th.
17,632. "Electro magnets." J. Neale and J. A. Manners Smith. June 28th.
17,634. "Variable-speed gear of portable electric drilling machines." F. W. White and White, Jacoby & Co., Ltd. June 28th.
17,646. "Insulated bars for coupling up electric switches." J. Appleby. June 29th.
17,676. "Shade retaining ring for electric lamp sockets." H. H. Bennett. June 29th.
17,682. "Metal filament incandescent lamps." J. A. Orange. June 29th.
17,683. "Induction motors." G. H. Fletcher and Metropolitan-Vickers Electrical Co., Ltd. June 29th.
17,703. "High-frequency amplifiers for radio telegraphy or telephony." W. R. H. Tingey. June 29th.
17,704. "Automatic temperature-controlling devices for electric heating appliances." B. R. Wingfield. June 29th.
17,708. "Electrical apparatus for explosive motors." V. Paquit. June 29th. (United States, August 17th, 1920.)
17,712. "Utilising small electric forces to control larger forces." F. H. Haynes Remage. June 29th.
17,718. "Multiple electric conductors." Vickers, Ltd., (J. Wearham). June 29th.
17,722. "Electro magnetic switches." British Thomson-Houston Co., Ltd. (General Electric Co.). June 29th.
17,727. "Cut-out for electric circuits." Bayerische Elektricitats-Industrie Rott & Co. June 29th. (Germany, July 15th, 1920.)
17,735. "Logometers." A. McNab. June 29th. (United States, September 20th, 1920.)
17,736. "Electrodes for electric welding." J. H. Patterson, Premier Electric Welding Co., Ltd. June 29th.
17,748. "Electric apparatus for sending out time, &c." M. P. Favre-Bulle. June 29th.
17,765. "Secondary cells or batteries for electricity storage." C. G. Smith. June 30th.
17,784. "Electric accumulators." C. J. J. L. de Vos. June 30th.
17,785. "Electrically-operated switches, &c." L. H. Wordsworth. June 30th.
17,789. "Oscillating gear for electric fans, &c." A. H. Railing. July 1st.
17,798. "Electric heating elements." W. Weeks. June 30th.
17,801. "Electric commutators or distributors." G. H. Jackson. June 30th.
17,802. "Electric insulators." G. V. Twiss. June 30th.
17,811. "Electric conductors." British Thomson-Houston Co., Ltd. (General Electric Co.). June 30th.
17,812. "Speed-regulating mechanism for dynamo-electric machines." British Thomson-Houston Co., Ltd. (General Electric Co.). June 30th.
17,815. "Utiliser for ambient and natural electro-magnetic energy derived from any luminous source." N. Mancini. June 30th.
17,820. "Dynamo-electric machines." A. H. Midgley. June 30th.
17,822. "Electric furnaces." V. Sgadari. June 30th.
17,839. "Negative resistance devices for electro-magnetic wave systems, &c." Radio-Communication Co., Ltd., and J. Scott-Taggart. June 30th.
17,844. "Protective apparatus for electrical systems." Metropolitan-Vickers Electrical Co., Ltd. June 30th. (United States, September 8th, 1920.)
17,856. "Electric switches forming part of incandescent lamp fittings." F. P. Waltho. July 1st.
17,870. "Means for handling loads on electrically-driven trucks." C. D. Cuppleditch and J. E. Stott. July 1st.
17,895. "Electric switches." W. L. Barber and Midland Electric Manufacturing Co., Ltd. July 1st.
17,924. "Switch-gear for electric currents." Maschinenbau Akt.-Ges. Seebach-Zurich and J. E. Pollak. July 1st.
17,926. "Preventing burning out of pressure-reducing valves." Chemische Fabrik Griesheim-Elektron. July 1st. (Germany, July 19th, 1920.)

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1918.

13,477. "Spark plugs." A. Press. August 15th, 1917. (118,632.)

1919.

31,575. "Electric transformers." P. Rabbidge. December 19th, 1918. (136,826.)
31,786. "Dynamo electric machines." British Thomson-Houston Co., Ltd., and F. P. Whitaker. December 18th, 1919. (164,779.)
32,197. "Electric lamps." W. R. Bullimore. December 23rd, 1919. (164,782.)

1920.

752. "Electrically-operated cranes, hoists, and the like." W. H. Scott and J. Bentley. January 9th, 1920. (164,784.)
3,362. "Telephones." R. L. Murray and Telephone Manufacturing Co. (1920), Ltd. February 3rd, 1920. (164,790.)
3,879. "Electric switches." J. A. Crabtree. February 9th, 1920. (164,794.)
4,244. "Device for determining the direction of submarine sound waves." Signal Ges. June 5th, 1918. (138,918.)
4,306. "Electric switches." E. Waterhouse. February 12th, 1920. (164,799.)
4,667. "Storage batteries." G. J. van Swaay. February 15th, 1919. (139,169.)
6,914. "Electric condensers." L. Segal. August 14th, 1919. (Addition to 146,925.) (149,646.)
7,210. "Electrical liquid heaters." W. Marples. December 3rd, 1920. (164,820.)
7,348. "Electric switches." British Thomson-Houston Co., Ltd. (General Electric Co.) March 11th, 1920. (164,827.)
7,490. "Electrical signalling systems." Sterling Telephone & Electric Co., Ltd., F. G. Bell, and W. C. Davey. March 12th, 1920. (Addition to 106,706.) (164,831.)
7,824. "Magneto electric machines." British Thomson-Houston Co., Ltd., and A. P. Young. March 16th, 1920. (164,849.)
8,084. "Three-phase alternating current dynamo electric machines." Siemens-Schuckertwerke Ges. April 23rd, 1918. (140,452.)
8,440. "Electric ship propulsion systems." British Thomson-Houston Co., Ltd. (General Electric Co.). March 22nd, 1920. (164,873.)
8,680. "Electric distributor for internal-combustion engines." C. Valentine. March 24th, 1920. (164,880.)
8,829. "Electric heaters." A. Terry. March 25th, 1920. (164,885.)
9,046. "Commutators or electric current distributors of electric-ignition systems." J. H. Runbaken. March 27th, 1920. (164,890.)
9,433. "Thermionic relays or amplifiers." G. A. Mathieu. April 1st, 1920. (164,900.)
9,460. "Dynamo-electric machines." G. A. Juhlin and Metropolitan-Vickers Electrical Co., Ltd. April 1st, 1920. (164,903.)
10,248. "Terminal connections for flexible electrical cables." F. A. Griffin. April 13th, 1920. (164,911.)
10,333. "Electric heating device for metal melting crucibles." Fort-ified Manufacturing Co. July 18th, 1917. (141,719.)
10,539. "Thermo-electric measurement of temperatures." F. Rowcliffe and Cambridge & Paul Instrument Co., Ltd. April 15th, 1920. (164,916.)
11,241. "Electrical discharge apparatus and systems." Igranic Electric Co. (Cutler-Hammer Manufacturing Co.). April 22nd, 1920. (164,924.)
11,312. "Electro-magnetic wave receiving and transmitting systems." J. Robinson and H. L. Crowther. April 23rd, 1920. (164,927.)
13,185. "Means for bonding metallic tubing in electrical wiring installations." A. E. Ryeland and C. Ferguson. May 12th, 1920. (164,946.)
16,636. "Electric cables." L. R. Lee. June 19th, 1920. (164,965.)
19,480. "Controllers for electric motors." Constructions Electriques de Belgique Soc. Anon. March 18th, 1919. (147,516.)
19,531. "Apparatus for starting and protecting continuous-current motors." F. Krupp Akt.-Ges. May 14th, 1919. (147,594.)
20,573. "Process for regenerating energy in direct-current electric motors." Constructions Electriques de Belgique Soc. Anon. June 7th, 1919. (148,569.)
22,797. "Electro-magnetic device for withdrawing metal splinters from the eye." A. Gatti. July 31st, 1920. (164,988.)
22,972. "Process and apparatus for performing a thermic process of any kind." K. A. F. Hiorth. August 4th, 1920. (164,989.)
26,619. "Evaporative surface condensers." Sir W. Beardmore and A. Galbraith. September 17th, 1920. (164,999.)
26,983. "Electric miner's lamps." E. E. Gardner. August 30th, 1920. (Divided application on 159,665.) (165,001.)

1921.

13,059. "Time limit relays, circuit breakers, or the like." A. Reyrolle and Co., B. H. Leeson, and J. Mirrey. February 9th, 1920. (Divided application on 163,430.) (165,027.)
14,145. "Sound direction finding." Signal Ges. May 21st, 1920. (163,670.)